

AVIATION WEEK

SEPT. 7, 1953

50 CENTS

A MCGRAW-HILL PUBLICATION



FOR VICTORY AT SEA



Should the need arise again, the Cougar jet fighters above, plus other new Grumman Aircraft, will play as big a role in victory as did Panther jets in Korea . . . as did Grumman Wildcats, Hellcats and Avengers of task force fame in World War II.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION
BETHPAGE • LONG ISLAND • NEW YORK

DESIGNERS AND BUILDERS ALSO OF THE ALBATROSS TRIPHIBII

How Sundstrand Constant Speed Drives meet exacting requirements of modern aircraft!



Rugged reliability

Service records prove that Sundstrand Constant Speed Drives withstand electrical system overloads and shocks, plus everything the airplane may impose on the

way of vibration, temperature variations, G forces. The Drives are as rugged and reliable as the plane's engines, and require no special servicing.



Lightweight, compact design

The Satcho and Drive is the lightest, most compact drive ever built of comparable power and performance.



Versatile in application

There's one type, ... "package," "sandwich," and "cannibal" ... get available. One of these types is suitable for virtually any airplane application.



SUNDSTRAND AIRCRAFT HYDRAULICS

SUNDSTRAND MACHINE TOOL CO.
HYDRAULIC DIVISION, BROOKFIELD, ILL.

Plan to visit our booth at the 10th Aircraft Electrical Society Display, Los Angeles, October 15-16, 1953



Close control to provide parallel operation

Among constant speed drives, the Sundstrand development is unique in an ability to drive in generator in parallel with one or more other drive generator units. Because output speed holds frequency variation under steady state conditions to $\pm 0.5\%$... while under transient conditions of load and input speed, droop is small and recovery fast ... load division is maintained within $\pm 2\%$. The result—maximum reliability and flexibility of the electrical system over the entire range of input speeds and acceleration rates.



Meet all temperature and altitude requirements

Wherever the plane will go, Sundstrand Constant Speed Drives will operate efficiently. At altitudes from sea level to 65,000 feet—at temperatures from -65° to 250° F. ... under all climatic conditions ... the Sundstrand Drive performs with proven dependability. No attention in flight is required.



Call "Reddy-Tape" drive—used in fixed or limited speed applications for power take-off and



Multi "Satcho-Tape" drive—capacitatively cooled for steady high to low loads, or other special duty.



Call "Cannibal-Tape" drive—designed for steady state use.

B.F. Goodrich



New kind of De-Icer removes ice faster, cleaner

THIS IS YWA's new Super Cannibal. Its wings are safely protected against ice with a new kind of inflatable De-Icer. Up close, you might see the fair surface of layers of sand ribs, running along the wings. They work, like ordinary wide-tube De-Icers, by inflating and deflating to crack off the ice as it can be carried away by the airstream.

But they operate faster, with almost three times the air pressure. This greater action removes ice both faster and cleaner. There's a much longer "air period" between each time the ribs inflate. This means that there is no little disturbance of the airflow that

is not even a factor! In fact, these B.F. Goodrich De-Icers have been successfully flown on very high speed aircraft. And the new De-Icers last longer. They're inflated to exact shape and size, then simply retracted on the airplane. No stretching under tension, no mechanical attachments. They're lighter, take up little space for stowage.

The new "Type 21" De-Icers came out of years of basic research, plus many hundreds of tube arrangements on Mt. Washington, New Hampshire, where weather conditions are seldom-order but outdoor wing runs.

It adds up to another B.F. Goodrich development for the aviation industry.

For information on this or other BFG products and their origins. Check the items: price your name and address in the margin below (or put in your company letterhead).

- | | |
|-----------------------------------------------|-----------------------------------------------------|
| <input type="checkbox"/> Tires | <input type="checkbox"/> Pressure Sealing Systems |
| <input type="checkbox"/> Wheels and Brakes | <input type="checkbox"/> Cockpit Seats |
| <input type="checkbox"/> De-Icers | <input type="checkbox"/> Engines |
| <input type="checkbox"/> Naval Bombers | <input type="checkbox"/> Blue and other accessories |
| <input type="checkbox"/> Aircraft | <input type="checkbox"/> Flight Deck Adapters |
| <input type="checkbox"/> Flight Deck Adapters | <input type="checkbox"/> Flight Deck Adapters |

Mail to The B. F. Goodrich Co., Dept. A-66, Akron, Ohio



Forgings for the aircraft industry today demand the utmost in engineering and production techniques and in scientific laboratory control. This massive complicated landing gear component, weighing over 400 pounds, is typical of Wyman-Gordon's forging contribution to the ever-growing progress in aircraft design. In crankshafts for the automotive industry and in all types of aircraft forgings, steel and light alloy, Wyman-Gordon has pioneered in the development of forging "know-how"—there is no substitute for Wyman-Gordon experience.

Standard of the Industry for More Than Sixty-five Years

WYMAN-GORDON
FORGINGS OF ALUMINUM • MAGNESIUM • STEEL
WORCESTER, MASSACHUSETTS
HARVEY, ILLINOIS DETROIT, MICHIGAN



First Photo of New Stratofortjet Tanker

Boeing KB-47B Stratofortjet tanker (upper right) is seen refueling a B-47 bomber in mid-air using British-developed probe and drogue system. The tanker photo carries the necessary fuel tanks, pumps, hoses, cables

strutbars and hose and reel inside the back bay. The bomber B-47 has a probe mounted in the upper nose. It is estimated the B-47 can be converted from bomber to tanker and vice versa in a few hours, as

crossing the plane's refueler container. The Stratofortjet tanker train was assigned to operational readiness tests at Eglin AFB, Fla., was scheduled to be demonstrated at National Airshow, Dayton, Sept. 9-17.

Domestic

Republic Airlines DCA dispatched its Pacific Northwest last week on a military charter flight from Monterey, Calif., to McChord AFB, Ore. The transport carried 22 soldiers and a two-man crew.

Boeing X-5, experimental jet with a variable sweep wing, will stage a demonstration flight this week at the National Air Show in Dayton. Air Research and Development Command announced last week. Other ARDC aircraft scheduled for the show: Bell X-1B research rocket jet to make first flight; North B-7; Martin XB-76; project PICOON; Republic YF-12; and Convair B-36 A-10A bombers. B-47 Ratio and drag chute landing.

Aircraft Industries Assn. reported last week that U.S. manufacturers have delivered 10,000 jet planes and 40,000 engines to the air force.

CAA surveys expanded 10,000 mi. during the test ended June 10, showing total length of route between controlled airways (VOR) in the U.S. to 52,000 mi. A survey of air navigation facilities shows alternate VOR surveys were increased from 10,000 to 20,000 mi., and instrument routes were increased from 15,000 to 19,000 mi.

Lockheed XL-15B, Constellation Co. a machine-powered liaison plane, has been delivered to USAF.

Scandinavian Airlines System has agreed an extension agreement with New York Airways that sets up helicopter service for SAS passengers at New

York's Idlewild International, La Guardia and Newark Airports.

Financial

Lackland Aircraft Corp., Buffalo, Calif., last week reported record sales of \$109,111,000 for the first half of this year, more than doubling 1952's first half total of \$18,629,000. Net earnings were \$9,074,000, exceeding \$5,000,000 during the entire 1953 year. Building \$3,687,100,000.

Consolidated Vultee Aircraft Corp., San Diego, reports a net income for the half year ended May 31 totaled \$1,975,728, compared with \$4,012,196 for the corresponding period of 1952. Sales added up to \$19,714,574, an increase of \$10,418,779. Bookings as of May 31 was estimated at more than \$5 billion.

National Airlines reports a record net profit of \$4,554,465 during the year ended June 30, week doubling 1952's earnings of \$1,967,086. Operating revenues climbed 16.45% to a new high of \$10,914,000.

Pring Tiger Line had an all-time high net profit of \$1,800,000 in the 1952-53 fiscal year ended June 30, compared to \$1,361,695 for 1951-52. Revenues totaled \$25,737,697, an increase of 18%.

Northwest Orient Airlines reports net income of \$655,475 from operating revenues of \$15,192,686 for the first seven months of this year, compared with a net loss of \$2,47,100 and \$29,946,465 in revenues during the former July period of 1952.

Republic Airlines had a net profit of \$75,234 during the first half of 1953, more than doubling earnings of \$39,577 for the first six months of last year. Operating revenues climbed \$196,795 higher than the first half of 1952 to \$2,900,310.

International

Air France Constellation crashed and burned on 10/23/53. M1 Constellation near Barcelona, France, last week, killing 33 passengers and the crew of eight.

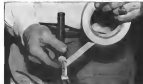
British Hawker Hunter piloted by Neville Duke crashed near a three-laborer course at Littlehampton, England, last week at an average speed of 712 mph. Last week, Duke's aircraft crashed in history. But the flight failed to set a new record, because it was less than 1% faster than the 715.89 mph record set last July by USAF Lt. Col. W. F. Burres in an F-86.

Aerobics guided missile designed in Canada is being put through flight tests, Canada Bureau of Defense reports. Aerobics missile is expected to be used in the test, although the Canadian CF-100 is expected to carry one.

British Falkland Goose is being considered by the Royal Canadian Air Force for production in Canada. The new jet is now near the thousands of RCNVR pilots, who protect modern facilities at two heavy and complex. The Goose works two times against eight tons for the F-86 and costs \$60,000, compared to the F-86's \$150,000.



Fireproof Polyken tape insulates fiber sleeve from intense arc welding heat



Fiber insulating sleeve gets fireproof jacket of Polyken Tape No. 280

Now they fireproof insulation with tape (OF ALL THINGS!)

Maker of welding rod holders stops breakdown of insulating sleeves with new Polyken fireproof tape

Two of Wichita was building a fine welding rod holder—but the product had an "Achilles heel" that was making serious cuts in sales. The fiber sleeve used as electrical insulation deteriorated under heat radiating from the 6000° F. welding arc. Plainly, the insulation needed insulating. But how?

Many materials were tested. But only one provided all the needed qualities—fireproof Polyken Tape No. 280. This tape protects the fiber sleeve as well they last 2 to 3 times longer. It sticks tight and stays stuck even under prolonged high temperatures. In fact, the solder it puts the tighter it sticks.

Tape No. 280 may not be the answer to your problem, but it's 10 to 1 there is a Polyken Tape that's tailored to one of your jobs. Tape can do things you never imagined—and save you time, money and effort in the long run. Let our engineers study your case—you've nothing to lose but your problem!

SEND TO YOUR JOB

Polyken®

INDUSTRIAL TAPES

Polyken Products Department of The Kennel Company



Polyken, Dept. JN7
300 West Adams St., Chicago 6, Illinois

For physical properties, samples and further information on Polyken 280 and other Polyken Tapes, please send me your FREE BROOKLETT. This is a Tool.

Name Title

Company

Street Address

City State Zip

WHO'S WHERE

In the Front Office

Edward C. Walsh, vice president-engineering of Boeing Aerospace Co., Seattle, is chairman of a new committee formed to discuss engineering and sales policy. Committee members: John O. Brenner, vice president finance; Paul H. London, vice president manufacturing; and James E. Patten, vice president administration.

W. C. Rockafellow has resigned as executive assistant to the chairman of the board and as a director of Continental Vultee Air Corp., San Diego, to join Allen Corp. Mr. Galt, Allen E. Corbin, retired Air National Command engineering executive, has been appointed general manager of Republic Aviation International S. A., Lugano, Switzerland, overseas subsidiary of Republic Aviation Corp.

Vern Allen, Ralph E. Jennings (USN Ret.) has joined Dornier Helicopters, Durbach, Conn., as executive vice president.

Thomas G. De, former chief engineer of Aviation Products, Wichita, and W. E. Diken, Jr., executive vice president, have merged at Wm. B. Smith & Co., Los Angeles, have formed DSO Engineering Co. to provide technical sales representation for aircraft equipment suppliers.

Changes

W. C. Blanton is now chief of the personnel engineering department, Northrup Aircraft, Inc., Hawthorne, Calif. Max J. Pennebaker has been appointed assistant president of light aircraft administration.

Whitney Dallas has been promoted to chief engineer of Continental Aviation & Engineering Corp.'s new Gas Turbine Division, Detroit.

F. W. Rowles has been named general sales manager of Bristol Co., Watertown, Conn.

Herman Adkins has been named general traffic and sales manager of Panair Air Lines.

Paul S. Richards is now assistant general manager for California Eastern Airways.

Michael Kitch has been appointed chief of engineering design, Fiat Engineering, Fiat Co., General Motors Corp., Akron, Ohio. Other design changes: A. D. Sharp, head of engineering equipment and service; J. M. Koser, chief of manufacturing engineering; and E. M. Fontaine, manager of plant planning.

Lamont H. Allen, Jr., has been appointed superintendent of electronics at North Coast Airlines.

Robert E. Graham has moved Fiat Inland Corp., Long Island City, N. Y., to assist in the design of public relations.

Honors and Elections

Dean Backlund, test pilot for Chance Vought Div. of United Aircraft Corp., is officially designated the "outstanding aviator" of the gathering held at the Test Pilot Training Div., Naval Air Test Center, Tainestown, Md.

INDUSTRY OBSERVER

► Douglas X-3 has reached Mach 1.25 (about 500 mph) in its exploration of the supersonic speed maze. X-3 is still being flown by Douglas test pilot Bill Bridgman and is powered by two Westinghouse J44 turbojets with afterburners. The strider, double-winged aircraft with straight leading edges have proved extremely effective in the transonic zone. X-3 is still scheduled to reach its design speed of Mach 3.

► Modification program that will be required for the Republic F-5H and the Wright F5 engine that powers it are among USAF items to take a hard look at the North American F-100 as possible replacement for the USAF and NATO fighter-bomber requirements. No decision has been reached yet.

► Air Force has indicated the interval between overhauls for all Conquest Electra M75, engine area, limited to 1,200 hr. This exception is the alternative engine J47-17 model.

► Short Brothers have a private venture research plane designed to test a new type "inertial" wing, described as a wing which can deflect without twist (Aviation Week, Nov. 13, 1972, p. 22). The follow research craft is not technically eligible for the B-58C show at Farnborough because its powerplants are French (two Turbomeca engines). But observers probably will have a chance to see it nearby.

► North American's Super Sabre F-105 is getting the paper shuffled to begin its Phase 2 flight tests at Edwards AFB, Calif., after getting through the performance of Phase 1 in full time with only a few routine problems.

► Use of a high-frequency radar system to give the pilot of an airplane a fix on where he should start his approach glide is proposed by NACA methods in one means of getting greater efficiency out of existing airport runways, as decreasing future runway requirements.

► Boeing B-47 bombers with new fittings for receiving Flying Boats, refueling tank, will have an extra lot which will enable them to convert to the probe-refueling system. The new probe fitting will be designed to attach into the nose coupling for the Flying Boats so other systems may be used.

► Tecon Aircraft Corp. is starting to test for a new McDonnell Sabrejet at Dallas to produce new fuselage assemblies for the Air Force F-101 Voodoo. This is in addition to McDonnell F104. Defense Navy jet fighter subcontract for order wing panels, create wing sections and aft fuselage sections. Latest subcontract amounts to about 35% of the Tecon airframe.

► USAF has dropped the "X for experiments" letter from the designation of the post-warplane Conquest X-39 cargo transporter, nicknamed in the plane's recent trans-Atlantic flight to Alamogordo, California, would be as an experimental, non-operational, plane. The C-39 looked back at KSC, AF-3, Vol. 3, just a week after it left, covering a total of 10,000 mi. on the Conquest.

► CAA likes the National Bureau of Standards' electronic transmissionster, which meets visibility changes on Washington National Airport's instrument runway No. 36, going into operation automatically where visibility drops to 1/2 mi. and reducing its radius on shift in the next two. These new transmissionsters will be installed this fall at the main New York airports, International, La Guardia and Newark.

► NACA has interchanged the F-105 Sabre for high-speed research at Ames Laboratory, Calif. In one configuration, as the YF-105, it has a low tail, as another, it continues to the production F-105 high tail.

► British Royal Aero Club circles are sounding why USAF hasn't made more of its recent trans-Atlantic jet flights official record hops by conducting through the U.S. and British representatives of Farnham Airman's International. The recent B-47 hops and the F-4H meeting flights from Albany, Ga., to Lakenhead, England, both of which occurred.

No Cut in Plane Spending

The President's \$1 billion slash in federal spending for this fiscal year isn't going to affect the aircraft program. Defense Secretary Charles Wilson's original cut rate of an \$8.5-billion expenditure—\$6.5 billion by Air Force and \$2 billion by Navy—for aircraft and related material purchases can be high. This is not the result of a piecemeal effort to hold down spending, however, but because production on some types is not coming along as fast as anticipated.

Defense officials concede, though, that the economic implications of the Joint Chiefs of Staff's plan after the review of the military program and the decisions of the National Security Council may change the plane spending picture.

Wilson on Profits

Defense Secretary Wilson isn't talking to Democratic governors to put his business supporters to work and save money for the government by toughening up on regulations and investigations of defense contractors. It is pointed out, for example, that over a 1% saving on this year's \$5.5 billion would be \$57 million.

Texas Rep. George Minton quoted Wilson: "So you think the government is getting its money's worth out of the contracts with industry?"

Wilson: "I think they are in most cases."

Minton: "That they should not expect more savings in that field purely on the basis of the negotiation of contracts?"

Wilson: "That is right."

Navy: No Unification

Navy is going along with Defense Department's unification study because it is so accomplished fact. But Undersecretary Robert Anderson says Navy is largely itself decentralized.

Instead of USAF's "Process" organization, in which a layer of deeply seated assistants report to assistant secretaries who report to the undersecretary and the secretary, this is how Navy is organized:

- The undersecretary, two assistant secretaries and administrative assistant are organizationally all on the same level and report to the secretary. The assistant secretaries aren't under the undersecretary.
- The chief of staff and Navy's seven other technical branches have autonomous staffs and report directly to the secretary.

USAF's Main Target

Top Air Force officials say publicly in an Air Force symposium around Defense Undersecretary Ralph Kirt's visit to Belmont are good, they are. Real target of USAF opposition: Assistant Secretary W. J. McNell, Defense Department controller. They blame him completely for this year's cuts in Air Force funds. The opposition to McNell goes back to USAF's beginning, during the regime of the late James Forrestal in Defense Secretary.

Some observers think USAF is timing to woo and win Kirt and Wilson from McNell.

Airworthiness Status

Industry opposes airplane postponement of the final part of the investigation review as new transport category airworthiness requirements which CAA issued last Oct. 5 in Washington. It is a widespread concern of the major transport manufacturers are not prepared to comment on questions raised at this time and will wait for postponement until later in the year. As a result, this year's shortcomings review will not be considered as important to the industry is in its producing year and a relatively limited industry response is expected in Washington when the general session start Sept. 21.

Airline Buying

Top U.S. airline executives are telling domestic aircraft manufacturers they will be ready to order gas turbine-powered transports for at least another seven years. Many reasons. They want to get a better economic fix on how future traffic levels will develop.

Also, threat of foreign competitors, particularly on the long-haul, wide-body route, appears to be receding. U.S. has lost the DC-7 and Super Constellation with the only seven Constables on long-haul operations for some years to come—probably economically.

Atomic Development

Confidence in the future of atom-powered aircraft development resulted from the recent cancellation of a contract with Convair to develop a flying test bed for its atomic aircraft engine under development by General Electric. Work on atomic powerplants for aircraft will be continuing at GE and Pratt & Whitney Aircraft, and USAF experts in the field are confident nuclear power use of aircraft eventually will be realized.

British Slipping?

There is a growing number of indications that British aircraft development is falling behind the U.S. in light-air and business aircraft from the transonic cruise into speeds of more than twice the speed of sound.

No British Lightnings has flown as fast as subsonic level flight as the North American F-100. A new design wing British all-weather fighter scheduled to fly this fall has a design top speed of more than 1,800 mph less than the design speed of a similar U.S. delta, also scheduled to fly this fall and built for the same type of all-weather interceptor mission.

British have neither the research facilities required for expensive work nor the production capacity to handle the new methods of aircraft construction demanded by Mach 2 fighters and bombers.

Selective Screening

USAF top officials have still in assessing the overall procurement program with a view toward weeding out plans of existing facilities and concerns can. CILC also disburse it as "stripping down to the essentials." Programs in which aircraft are meeting performance to present USAF and not scheduled for high priority, military missions will not be affected.

—Washington staff

New Red Development Threatens U. S.:

Soviet H-Bomb Stirs Air Power Debate

Re-evaluation May Push Air Force and Navy Strength Past Goals Set During Korean War.

By Robert Hotz

The blast of Russia's hydrogen bomb last month is stirring a new debate on the future of America's air power.

Most military observers agree that the combination of the Soviet hydrogen bomb development with production of a fleet of long-range turbojet bombers (Aviation Week Aug. 31, p. 11) poses the gravest military threat to the United States in its history.

► **New Outlook**—Last week as top military and civilian officials of the Executive Administration began to grapple with implications of this vital new factor in the military equation, the following results of the Russian experiment recently were evident in Washington:

- **Adequate air power** will be a major issue when Congress reconvenes.
- **Consequences of allied Washington**—induced by the Russian threat, darkly seen in Soviet satellite countries and the Russian press observers of early summer—has been observed.
- **Joint Chiefs of Staff** must re-evaluate their strategic studies around the basic fact of Russia's growing air threat to the United States.
- **Increased defense** has been reinforced that top U.S. military and scientific personnel continuously have mutually warned Soviet's technological capabilities.
- **First Soviet atomic explosion** occurred on the fall of 1949, approximately three years before U.S. scientists.
- **The surprising** McNell's presence in Korea in 1951 in far greater contrast than U.S. production of comparable fighters.
- **The H-bomb explosion** occurred about 18 months before U.S. estimated.
- **Likely Results**—Among the trends likely to result from the current combination of the Russian hydrogen bomb development are:
- **Increased emphasis** on military air power. Both USAF and Navy Airframes are likely to expand beyond their top Korean war goals.
- **Wider debate** on the type of air power required to meet Soviet U.S. needs. Heavy political pressure will be exerted for increased emphasis on air defense, but USAF will not be forced to compromise top priority for Strategic Air Command's long-range striking force.
- **Revised of USAF** message of the means for delivering the most devastating conventional attack on the Russian heartland. Present state of hydrogen bomb development is likely to involve relatively long bomb payloads that can be carried only by the large, long-range bomber.
- **USAF will again** the delivery means—likely to hold during early atomic bomb development but recently held by development of smaller A-bombs capable of delivery by fighters.
- **Wider political debate** with the Democrats attacking the Republican \$1.6 billion dash in air power on the eve of the Russian hydrogen bomb development as jeopardizing national security.
- **Defense Secretary Charles E. Wilson** is likely to be a political casualty in this debate.
- **More emphasis** on air-to-air combat over far more delicate of key airframe development and air installation.
- **H-Bomb Carrier**—U.S. designs to de-

velop capable of hydrogen bomb will have not made aircraft wars ago during the Russian Administration and recently was mentioned by a top-level USAF official. President Eisenhower to present with a production program for several hundred Boeing B-57 Stratojets.

The giant jet bomber powered by eight Pratt & Whitney 17,000 horsepower, is the only gas turbine powered aircraft that will be able to carry a hydrogen bomb as the feasible future.

The composite-powered B-36 undoubtedly is capable of carrying a hydrogen bomb, but at one time the target speed would make full penetration to targets a only venture in the immediate future.

► **USAF vs Navy**—USAF's decision to build a jet-powered H-bomb fleet is based on two photographs, that the best defense to a Russian attack on both gas bombs attack on the United States is the maintenance of a capable offensive capability. Navy's policy of delivering atomic or hydrogen bombs exclusively on key Russian centers within a short time after the start of a Red offensive.

The issue discussed is a key point in the military side of the long-range strategic bomber versus the Navy carrier fleet, three.

► **Carrier**—USAF can be delivered at 700 mph, be on from U.S. bases to Russian targets in less than 24 hours. Unless carrier task forces already on sea position before a Red attack, it would take the ship days to steam into position at 10 knots before getting within range to launch attack on Russian targets.

► **Large Payloads**—Until the use of the hydrogen bomb package is reduced drastically, long-range bombers are likely to be the only effective method of delivery.

It is obvious, however, that the trend as reflecting the use of atomic bombs probably will be expanded in hydrogen bomb development. But it seems doubtful now if they can ever be utilized to fighter aircraft use because the hydrogen bomb contains an atomic bomb at its trigger mechanism.

This fact seems likely to preclude the

Halfway Point

The aircraft industry is short at the halfway point in equipping U.S. military services with atomic aircraft. DeWitt C. Rogers, president of the Aircraft Industries Assn., told the American Legion convention at St. Louis.

Rogers and U.S. manufacturers have produced more than 25,000 aircraft since 1950, currently are looking for current rate of approximately 12,000 a year and have a backlog estimated at 25,000 scheduled for delivery within the next 12 months under current programs.

use of Navy carrier-based aircraft in hydrogen bomb warfare, although long-range Navy B-57 bombers such as the Convair F-102 and Martin P-61 could be adapted for this work.

► **Trained Air Power**—The growing Russian air threat also will mean increased emphasis on training air power and less reliance on Soviet and National Guard squadrons.

In event of a Russian air attack, there would be insufficient time to mobilize Reserve or National Guard squadrons.

This type of atomic or hydrogen blitz would have to be paired with combat power already in the area to fight.

► **Increased Defense**—It appears obvious that, whatever other types of warfare the Joint Chiefs of Staff recommend, they probably will be given to the task of providing a "safety net" effective against the Russian air threat.

This undoubtedly will mean acceleration of many defensive trends already underway in USAF such as:

- **Reliance** on more and smaller ground radar for better coverage of the sky.
- **Automated** ground radar nets by radar pilot plot phones to cover air and auto approaches to North America.
- **Increased** trend toward all-weather, electronically controlled interceptors.
- **Development** of automatic electronic ground control systems for receiving, correlating, and transmitting to interceptors all data on attacking planes.
- **Development** of longer ranging and more accurate air to air missiles.

However, USAF feels that no matter how much time, money, manpower and material are invested in an air defense system, it will not be able to prevent serious damage from an atomic or hydrogen bomb attack.

One of the critical matters the Joint Chiefs of Staff must decide is how much of the total military resources available to defend the U.S. must be allocated to defense of the U.S. against an atomic or hydrogen bomb attack.

► **Obsolescence**—Russia's offensive air power will involve:

- **USAF** construction of a fleet of hydrogen bomb-carrying B-57 capable of long-range operations at just under 100 mph.
- **Obsolescence**—Russia's offensive air power will involve:

► **Obsolescence**—Russia's offensive air power will involve:

- **Obsolescence**—Russia's offensive air power will involve:

► **Obsolescence**—Russia's offensive air power will involve:

- **Obsolescence**—Russia's offensive air power will involve:

use of Navy carrier-based aircraft in hydrogen bomb warfare, although long-range Navy B-57 bombers such as the Convair F-102 and Martin P-61 could be adapted for this work.

► **Trained Air Power**—The growing Russian air threat also will mean increased emphasis on training air power and less reliance on Soviet and National Guard squadrons.

In event of a Russian air attack, there would be insufficient time to mobilize Reserve or National Guard squadrons.

This type of atomic or hydrogen blitz would have to be paired with combat power already in the area to fight.

► **Increased Defense**—It appears obvious that, whatever other types of warfare the Joint Chiefs of Staff recommend, they probably will be given to the task of providing a "safety net" effective against the Russian air threat.

This undoubtedly will mean acceleration of many defensive trends already underway in USAF such as:

- **Reliance** on more and smaller ground radar for better coverage of the sky.
- **Automated** ground radar nets by radar pilot plot phones to cover air and auto approaches to North America.
- **Increased** trend toward all-weather, electronically controlled interceptors.
- **Development** of automatic electronic ground control systems for receiving, correlating, and transmitting to interceptors all data on attacking planes.
- **Development** of longer ranging and more accurate air to air missiles.

However, USAF feels that no matter how much time, money, manpower and material are invested in an air defense system, it will not be able to prevent serious damage from an atomic or hydrogen bomb attack.

One of the critical matters the Joint Chiefs of Staff must decide is how much of the total military resources available to defend the U.S. must be allocated to defense of the U.S. against an atomic or hydrogen bomb attack.

► **Obsolescence**—Russia's offensive air power will involve:

- **USAF** construction of a fleet of hydrogen bomb-carrying B-57 capable of long-range operations at just under 100 mph.
- **Obsolescence**—Russia's offensive air power will involve:

► **Obsolescence**—Russia's offensive air power will involve:

- **Obsolescence**—Russia's offensive air power will involve:

► **Obsolescence**—Russia's offensive air power will involve:

- **Obsolescence**—Russia's offensive air power will involve:

► **Obsolescence**—Russia's offensive air power will involve:

- **Obsolescence**—Russia's offensive air power will involve:

Chase Aircraft Splits Into Two Companies

Two aircraft firms emerged out of one last week.

► **Strockoff Aircraft Corp.**, owned by Michael Strockoff.

► **Chase Aircraft Co.**, owned by Maxine Chase Corp's subsidiary, Willys Motors.

Strockoff, founder and chief engineer of Chase, joined company with Willys Motors Co. which had owned 55% of Chase. In doubling the production, Chase and Strockoff 52,500 (Aircraft Week Aug. 17, p. 418) to form a new corporation and bought the remaining 51% of Chase.

With the new and expanded stock, which amounts to 110,000 shares, the total now million shares, Chase also gets rights to the Chase-designed C-121B aircraft transport, production of which bought the two firms in the making of the new.

► **Strockoff Aircraft Corp.** also expects to go all Air Force research and development contracts, formerly held by Chase. Chase claims this is a point the Air Force must decide.

If they are awarded Chase, however, that firm claims it would still be the Air Force must decide.

► **Strockoff Aircraft Corp.** also expects to go all Air Force research and development contracts, formerly held by Chase. Chase claims this is a point the Air Force must decide.

If they are awarded Chase, however, that firm claims it would still be the Air Force must decide.

► **Strockoff Aircraft Corp.** also expects to go all Air Force research and development contracts, formerly held by Chase. Chase claims this is a point the Air Force must decide.

If they are awarded Chase, however, that firm claims it would still be the Air Force must decide.

► **Strockoff Aircraft Corp.** also expects to go all Air Force research and development contracts, formerly held by Chase. Chase claims this is a point the Air Force must decide.

If they are awarded Chase, however, that firm claims it would still be the Air Force must decide.

► **Strockoff Aircraft Corp.** also expects to go all Air Force research and development contracts, formerly held by Chase. Chase claims this is a point the Air Force must decide.

If they are awarded Chase, however, that firm claims it would still be the Air Force must decide.



LACK OF LEADING EDGE SLATS is typical to Sabers in recent new wing design.



EXTENDED LEADING EDGE, small wing known (shown at rear) are detailed in design.

F-86 'Gimmick': Improved Wing

New leading edge steps up Sabre performance, enables it to outmaneuver MIG-15 in high-altitude combat.

By William J. Coughlin

Los Angeles—A brilliant secret project in the wing design of North American's F-86 Sabre jets was the unobvious "gimmick" that boosted the U.S. victory, says a MIG pilot flying the Sabre, says it now can be reached.

An extended leading edge step design buffeting of a high-speed stall improved performance of the Sabre and enabled U.S. fighter pilots to outmaneuver MIG-15 in high-altitude combat.

► **Controlled Secret**—Sometimes known as the "61 leading edge" because it slightly increases wing area of the Sabre wing by extending it forward at the root and there exists at

the tip, the new leading edge replaces wing tips of earlier models.

Wing losses are added to improve stability.

USAF learned critical importance of the safety guarantee and improved engine performance to the steadily widening margin of Sabre jets at war's end, but the new wing remained a closely guarded secret—although some F-86s thus equipped undoubtedly fell into Communist hands when shot down in MIG Alley. Recently now has been

► **Unlikely G-45**—If this coming off the assembly line at North American's plant here have the improved wing, and modernization kits have been added to aircraft already delivered to the Air Force.

There actually is no increase in the maximum G forces a pilot can sustain on a Sabre as a result of the modification.

But the fact that the new leading edge delays buffeting gives a pilot an increase in usable G's, allowing him to fly closer to maximum G before buffeting starts. This means improved maneuverability at high altitude.

► **Disadvantages**—Possibly paid for fine improved performance is higher stall-speed speed and a yaw-roll effect at low speeds.

The unusual roll step procedure the still makes it necessary for pilots to fly a roller and then leading pattern, looking around about 150 knots on the final approach and using caution in dropping a wing on the turn. Touchdown speed must be increased 10 knots to a 120-knot minimum, thus requiring a longer landing roll.

Roll turning in the form of a buffet occurs at approximately 120 knots with flap down. Right roll and yaw in alternate direction begins around 115 knots and, at 105 knots, the aircraft stalls and drops off on one wing. Sabre pilots also must exercise greater caution in sudden flares during landings.

► **Control Performance**—Pilot pilots in Korea were willing to accept these disadvantages in return for the increased performance. "The war isn't won in the traffic pattern," one remarked.

Sabre pilots of the Fourth and Tenth Fighter Interceptor Wings in Korea gave the extended leading edge credit for greatly increasing their combat effectiveness in MIG Alley.

► **Test Pilot's Idea**—The new wing design was suggested by North American's chief design engineer, William J. Coughlin.

Conferences with Ray Rice, NAA's engineering chief, and Fred Pitt, P-85 project engineer, resulted in a decision to test a new leading edge.

After Air Force tests at Edwards AFB indicated the design change would improve combat performance of the Sabre, 50 kits containing the extended leading edge were shipped to Korea late last summer for installation in F-86s in that theater.

► **Increased R&D**—The combat test brought immediate reports that F-86s Air Force jets kits to modify all F-86s currently in Korea.

► **Then MIG-15**—The aircraft was destroyed using modified aircraft. It reported one group. "The human advantage was really apparent. No tracking problems were encountered. Our side, however, had an extremely high G and high Mach speeds."

► **Then MIG-15**—The aircraft was destroyed using modified aircraft. It reported one group. "The human advantage was really apparent. No tracking problems were encountered. Our side, however, had an extremely high G and high Mach speeds."

marked on moderns while looking out on additional turning capabilities."

Fighter pilots reported the modified Sabre turned better and climbed better than on unmodified F-56. Level flight speed was said to be slightly higher in all altitudes. Lower drag coefficient, from the canopy and wing shape, meant slightly improved range for the Sabre, because it resulted in higher speed with no power setting increase.

► **Trimming Manoeuvres**—Although buffer preceding a high-speed stall began at a higher G, there was no difference in accelerated stall characteristics above that point.

Since a high-speed turn could be sustained considerably before buffer started, an F-56 pilot could turn in a

radius half at higher altitudes without losing speed as rapidly. In MRF-40, this same in additional 14 G could be pulled at Mach 92 at 10,000 ft before buffeting began.

Some pilots realized this with reference to the Sabre's turning advantage. It said for a time by the improved MRF-40 with a clean nose.

► **Rise Conversion**—Changeover to the new leading edge is comparatively simple. The job, costing about \$4,000 each, can be installed overnight by a two-man crew.

Some maintenance trouble was caused by a "clip art" action used to fix the new leading edge into the fast lag.

This action, which had to be accessible to permit opening of emergency

door access doors, sometimes was lost in flight. Examination of the leading edge showed it was necessary to trim drop-back damage slightly.

► **Wing Sweeping**—Elimination of the completed wing slots previously employed on the F-56 leading edge resulted in a single series of sawtooth slats less than 100 ft. The new wing design also simplified production techniques, according to Pratt.

Provisions were necessary due to changes in surface areas, the surface, which required down replacement of the slats by the extended leading edge.

NAA leading edge studies are continuing.

► **Elaborate Procedures**—Security provisions in Korea to protect the secret of the new wing were elaborate. During Dwight D. Eisenhower's visit, photographs were cautioned to keep the leading edge and wing down part of camera view when photographing the President-elect on the wing of a Sabre. Photographers sometimes were laid, apparently casually, on the wing fences when photographing at overseas news men.

Gen. Hoyt S. Vandenberg, hosted at the secret during his visit to Korea when he told war correspondents a new wing configuration was one of the "game-changes" improving "performance" of Sabre against MiGs. Commanders refused to clear his remarks.

► **Important Elements**—The extended leading edge alone was not responsible for the Sabre's high lift ratio during the final months of the Korean war. An improved radar receiver, better-performing engine and increased pilot skill were among other factors that combined to give the F-56 its past superiority.

But there was little doubt in Korea that the new wing design was a very important "game-changer" in the final air high over the Yalu.

SAC to Get Base in New Hampshire

An F-4 was added a Strategic Air Command base to its new base program last week, one of 14 originally set from the program. USAF awarded the Portsmouth, N. H., base to its 55th million project. The will give SAC a total of 15 bases.

Located at Newington, just outside Portsmouth, the base will support two B-47 medium bombardment wings and probably a strategic headquarters. When completed it will have two runways—10,000 ft and 5,000 ft long.

USAF and the base was authorized in its program after a study of new facilities construction "in the light of available funds." The base is located in the base state of Sen. Silvio O. Rogers, chairman

of the Senate Appropriations Committee.

Congress authorized \$46,550,000 and appropriated 244,025,000 through fiscal year 1955 for the Portsmouth base. Through May this year, \$3,386,637 had been obligated towards it.

Kaman Phases Out HTK at New Plant

Kaman Aircraft Corp. last week opened its new New-Orleans plant at Bloomfield, Conn., and at the same time started phase-out of its first production helicopter, the HTK-16 trainer, in favor of a newer and more versatile machine.

Let of the HTKs now going down the line at the new plant will be followed by longer HTKs, approximately 1,000 lb. heavier with a more powerful engine and designed to carry four passengers—or a pilot, medical attendant and two other patients (Aviation Week May 11, p. 15).

The HTKs use the same type transverse-hub two-blade rotor as the earlier Kaman, with changes in rotor pitch actuated by screw-type and small details about one-third the distance in board from type.

However, the HTKs use a new and improved design with hinges at both ends instead of one hinge in the middle as was the case on the earlier models.

The new Kaman plant has 108,000 sq ft. of floor space on an 85-acre site, providing a good helipad and room for future expansion.

J71-A-7 Will Power Delta-Wing F-105

An F-4 was added a Strategic Air Command base to its new base program last week, one of 14 originally set from the program. USAF awarded the Portsmouth, N. H., base to its 55th million project. The will give SAC a total of 15 bases.

Located at Newington, just outside Portsmouth, the base will support two B-47 medium bombardment wings and probably a strategic headquarters. When completed it will have two runways—10,000 ft and 5,000 ft long.

USAF and the base was authorized in its program after a study of new facilities construction "in the light of available funds." The base is located in the base state of Sen. Silvio O. Rogers, chairman



DOUGLAS SKYROCKET rocket-powered research plane, which was carried aloft by Boeing Superfortress and then released to set new unofficial height record of 81,235 ft.

83,235 Ft. Up

- Marine pilots Skyrocket to new altitude mark.
- But speed run falls short of 1,238-mph. record.

Los Angeles—Marine Lt. Col. Martin E. Carl set an unofficial world's altitude record of 81,235 ft. in the Douglas D-755-11 Skyrocket Aug. 31, the Navy revealed last week.

The mark, topped by almost a mile the 79,440-ft. altitude reached by Douglas test pilot Bill Brundage in the same rocket-powered aircraft Jan. 15, 1953.

Carl failed on an attempt at 74,000 ft. in the Skyrocket, but the Douglas D-755-11 Skyrocket Aug. 31, the Navy revealed last week.

Carl failed on an attempt at 74,000 ft. in the Skyrocket, but the Douglas D-755-11 Skyrocket Aug. 31, the Navy revealed last week.

Carl failed on an attempt at 74,000 ft. in the Skyrocket, but the Douglas D-755-11 Skyrocket Aug. 31, the Navy revealed last week.

Carl failed on an attempt at 74,000 ft. in the Skyrocket, but the Douglas D-755-11 Skyrocket Aug. 31, the Navy revealed last week.



LT. COL. MARTIN E. CARL, USMC, wearing newly developed high-altitude flying suit, steps out of Douglas D-755-11 Skyrocket following flight to 81,235 ft.

"I was down to 25,000 ft. before I got it fired and headed up again," he said he pointed the Douglas Skyrocket straight up in an over-the-horizon climb, reaching a 40-deg. angle with its rocket hot exhausted at 71,000 ft. The Skyrocket's momentum carried it over 51,000 ft. to give the 31-year-old Marine from the detachment of seeing higher than the earth than man ever before had reached.

► **Not Official Record**—The Federation Aeronautique Internationale will not recognize his work as official since present rules specify that records have to take off the earth from its own power for man to qualify as official.

Carl said he was two days at the mouth of his climb to look over the problem of control," he said. "The plane wants to allow control a bit and the nose is slow going over. The



PARASITE FIGHTER MECHANISMS REVEALED

New photos of USAF bomber-parasite fighter jets provide closing look at world's most advanced jet in the air today (Aviation Week Aug. 31, p. 11). The photos show modified Republic YF-104F (parasitic fighter) with some modifications; some lowered length Corvus RB

MD (parasitic fighter). Lower wing ditch YF-104F modification: 1. noticeable, horizontal tail attached to parasitic fighter to fit snugly in bomber's belly; 2. fitting to engage nose position at launch from base; 3. nose probe which is retracted into forward section of fuselage forward from the bomber

briskly is to come straight down, after you do push over. You don't engage full clutch until you pick up speed again.

Coached by Vietnam-NACA, has been flying the Skuas for the past two years in an altitude and high-speed research program. Carl, operations officer at the Marine Corps Air Station, Quantico, Va., was coached by his mentor

Hard Selling to Rule SBAC Show

By Nat McKinnick
McGraw-Hill World News

Farnborough, English-Flag) will be the order of the day for the 1957 Society of British Aircraft Constructors flying display and exhibition. By and large, the show features production models of the interesting prototypes that caught the headlines in the last two decades.

SRAC notes that "almost without exception, every type of aircraft put into quantity production in British factories goes for export in one way or another."

► **NATO Display**—On the military side, visitors see what amounts to the whole of Western Europe's contribution to NATO air defense—barring France's Dassault Mirage.

Through off-shore purchase contracts and direct sales and licensing agree-

ments with European governments, the British aviation industry has made a big virtue of this security.

• **Turbine Transports**—On the civilian side, turbine—especially American—will see the only competition to U. S. transport builders, a competitor that still has a miserable lead in the new business of turbine engines.

Salesmen for the St. Hyland Courts, Bristol Britannia and Victoria Viscounts will be talking operational experience and listing of big new projects to come.

RAF Lieut-Military aircraft crash off the coast last week will be in show supply. But for the first time in public, the Sunday Page Victor aircraft was shown, powered by four Armstrong-Siddley Sapphires jet engines, will take its place alongside RAF Bomber Command's other two V's—the Avro Vulcan, four Bristol Brabants jets, and the

Viklem Ammal	Vikant	Chou	Bella-Royce
-----------------	--------	------	-------------

And for the first time, production models will be shown of B&W Fugate

In the all-weather class, the Glenshire wins delta (two Sapphires) will be not enough, as some would be.

pre-designs are being, it was the Dornier 110 (from Aeros), prototype of which crashed at last year's show. The DHI 110 will be wearing Royal Navy colors, indicating which way its development is leading. Final design of the two-bomber fighter is likely, however, to be altered considerably.

★**New Short-Take**—The newest aircraft in the show, Short Bm S B 6 also designed for the Royal Navy. The S B 6 is a carrier-based, anti-submarine aircraft with acoustic sonar under nose. It will be powered by an Armstrong Siddeley Mamba turbo-prop that runs on diesel fuel. The British Navy hopes to use it to replace its of current

Shurt Bros. also has two new entries in the research category. The SB-3 adjustable wing test mannequin will be shown with wings pegged back at 60 deg. The mannequin's wings are adjusted manually before flight.

• **2,000-Mph. Rocket**—Also on the ground, visitors will get a slight hint of the way Britain's missile program is developing. An early Armstrong Whitworth rocket, with boosters sockets grouped around the main body of the vehicle, will be on display.

Last week Messer, of Supply Division 82nd, announced that Eryon had developed "a 2,000-psi gaseous jet-engine rocket which no piston aircraft could hope to outmaneuver."

► **London Song**—The virtues of turbopeps will be the لندن song of civil transport policemen at the show. The *World Betwixt* will appear for the first time with an regular engine—Preston 750. Both *World* and *Valet* are developing bigger and better turbopeps, whereas the *Betwixt* and *Valet* are not.

Dr. Hordleach, currently getting the most of the kudos over turboprops and turbosets, will plug the Conquest 3 prototype, which will be flying next year. Latest DH specs for the Conquest 3 show a range "up to 2,500 mi" and a capacity of from 55 to 76 passengers.

Such ideas will be demonstrated in upcoming fighter tenders to the

working from a plastic "house" of high strength and constructing facades with double-curvature without using big steel's services.

RAAF F-16—Military aircraft crash off the coast last week is in shrapnel. But for the first time in public, the Phantom F-16's exact crash site was revealed, powered by four Armstrong-Whitworth Suprajet jet engines, will take the aircraft to 50,000 ft. (The aircraft crashed) off the coast of the Aegean Sea, near Istanbul (Greece) last week.



STOFOFF FORMATION

in the JAFech-flamethrower class, each of the planes carries more than 3,000 lb and weighs 115 ft. The big bombast can outpace production line for the AF Strategic Air Command at Seattle, Wash.

FIRST PHOTO OF STRATOSFORT FORMATION

During nightpelt XB-52 (Overgrowth) and YB-52 (Sensiferous) are worn together as the is for the first time, their deeply swept wings accenting their streamlined shapes. Powered by P&W J37 split-compressor jets.

Convair...first choice
all over the world!



How's work?

[illegible]

bioRxiv preprint doi: <https://doi.org/10.1101/2018.08.01.228103>; this version posted August 1, 2018. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under aCC-BY-NC-ND 4.0 International license.

1000

IN THE COURSE, TOO, WE LEARN HOW
TO LIVE, AND HOW TO LIVE BETTER.

[illegible]

CONVAIR

For the U.S. Air Force, the Command is setting new records for versatility and performance... another milestone of General's **Immerging to the 10th Power**.

STEEL PRODUCTS— the Source for Gears and Geared Units



Want production of a single gear? A complete geared unit? The Steel Products Engineering Company can do the complete job, under one roof. We have our own engineering staff for design, test and development work, in addition to tool design, manufacture and approved quality control. Our facilities include complete up to date machining equipment, plus plating, heat treating, and welding. If you want precision contract manufacturing in a "package" make Steel Products your source.

THE STEEL PRODUCTS ENGINEERING CO.
ENGINEERS AND MANUFACTURERS • SPRINGFIELD, OHIO

Research Reply

- AF defends its human resources projects.
- But work is cut sharply for lack of funds.

Air Force's continuing struggle to research on human resources, mainly because of money limitations. But USAF has come to the defense of programs in this category, which have been the target of much criticism from Congress.

Projects that Sen. Herman Welles singled out for criticism (Aeronautics Week July 30, p. 13), USAF explains like this:

• "Disruption factor in determining suitability of jobs for women." Of course, the advertisement says that you must never underestimate the power of a woman." Welles observed, "but actually, I doubt that pilots at the Soviet air base are as free with the advertisement as we are, and, therefore, are not likely to have it as read as they do their MGRs in aerial warfare against USAF aircraft."

USAF explains "The military for years have been criticized for wasting manpower by putting the mouse peg into the round hole" in plain language, this project involves determining where a woman can replace a man, and then developing an efficient method to place each WAF recruit on the job for which she is best suited. As a result of this project, the Air Force can now assign WAFs with the same degree of certainty as on the job success as with males."

• "Survey of Alaskan volcanoes." "It may be that this was undertaken as a source for intelligence purposes for both sides before Russia's invasion," Welles suggested, apparently referring to Gen. Hoyt Vandenberg's experience to conflicts in USAF's budget. "I have detected more than casual similarity between some observations briefly on the budget and the similar and usually associated volcanic eruptions."

USAF reports "As recommended by the former Research and Development Board, this project is a joint enterprise of the Army, Navy and the Geological Survey. USAF's interest Volcano eruptions in the strategically important Alaskan area are of military significance since they can produce an extremely noticeable flying conditions can, in some cases, create whole cloud areas to disappear, and can cause profound changes in terrain and traffic visibility conditions."

For example, there have been eruptions in four different volcanoes in the Alaskan area in the past two months

which so dominated weather that aircraft had to fly on instrument-only through this in usually a period of complete daylight."

• "Determination of the principles underlying human conduct." "No doubt this research," Welles commented, "is conducted in sitcom clubs. I can think of no more likely place to serve as a laboratory for these vital experiments."

Air Force says that body comfort in seat and other crew positions is vital to the efficiency in operating high-altitude planes. The study is particularly directed to conduct of the fighter pilot, cramped as cockpit for long periods,

subjected to engine heat, the blurring of static over instrumentation equipment, and required to combine a large panel of controls.

• "Research on the emotional aspects of Air Force officers." "I am sure this project," Welles declared, "will shake terror into the hearts of Russian pilots. I earnestly hope that the public revelation of this particular project will so combat, frighten, and defeat the Soviet high command that the world's disarmament efforts will at last receive Russian support in the United Nations."

USAF reports "This project is



BRITISH TEST GUIDED MISSILE

British guided missile in new landing try ward also being fired from the blinding of supply test station at Aberporth, Wales. Top view shows missile being hoisted by

four guided rocket units during the actual stages of its ascent. Lower view shows missile thrust by the pre-launcher, still working as they fall backward.

abled at solving a major shortage, shifted people through better rotation. It involves inventory taking of reserve officers, who might, for example, leave the service in peacetime and subsequently become experienced civilians or engineers. It also involves testing the job aptitudes of West Point and Annapolis graduates coming to USAF.

Italian Amphibian Passes Certification

(McGraw-Hill World News)

Roma—A new version of the twin-engine Piaggio P.136L amphibian, powered by Lycoming engines in place of the Franklin previously used, has passed its type certification tests. The plane is fitted with three-blade Piaggio counter-rotating propellers.

With the Lycoming engines, the new P.136L's top speed is given as 181 mph, cruise being 17,700 ft. Cargo weight has been increased from 5,400 to 55,842 lb. With the normal useful load of pilot, four passengers and baggage, the twin-engine amphibian has a range exceeding 600 mi.

USAF Sets Heavy Press Program at 10

An F-4's heavy press program will remain at 10 passes.

USAF has decided to keep the passes left after the program was cut in June from 17. However, two passes started for Reynolds Metals Co. will now be transferred to two other firms (Aviation Week Aug. 10, p. 17)—putting the company out of the new program.

Reynolds had been slated for no \$300 and a 13,000-ton extruder prior after the initial cut. But when AF required the company to build its own housing at Phoenix, Ariz., for the two extruders, Reynolds decided it could not afford to provide its own funds for an Air Force project.

Kaiser Aluminum & Chemical Development Co., the \$300-ton extruder for St. Helens, Md., plant, and Harvey Machine Co., Tennessee, Calif., will get the 12,000-ton press in addition to its 12,000-ton extruder.

Here's the way the 10 passes finally line up:

- Forging—Wyan-Gordon Co., 50, 350 and 15,000 tons at North Grafton, Mass.; Alcoa, 100,000 and 55,000 tons at Cleveland, Ohio.
- Extrusion—Hawley, 12,000 and 5,000 tons at Torrance, Calif.; Kaiser, two 3,000 tons at Haleshorpe, Cumbria-Waggon Corp., 12,000 tons at Buffalo, N. Y.; and Alcoa, 11,000 tons at La Jolla, Ind.

Hail Warning Service Protects Aircraft

Twenty-three cities for stations at Denver have been linked in a hailstorm warning system to protect aircraft based at Stapleton Field.

Ray Wilson, vice president-operations of Frontier Airbase, suggested the plan and immediately secured full cooperation from the Denver Post Department.

Frontier keeps a lookout for hail and notifies the U.S. Weather Bureau stations at Stapleton of storm signs. Weather Bureau employees write the warning on Chequerboard, a network of electrically controlled wiring paths that transmit the message to the control tower, radio officers and small plane control centers.

The tower sends along information concerning the path of the storm to pilots in the air.

First CF-100 Mk. 4 Rolls Off Avro Line

First production model of the all-rocket-powered CF-100 Mk. 4 all-weather fighter has been completed by Avro Canada, Toronto.

The plane, which may be named the Jaguar by the Royal Canadian Air Force, carries 120 electronically aimed and fired rockets in its wing-pods. The installation initially was tested on an earlier CF-100 model.

Civil Aircraft, Engine Shipments

	1952	1952	1952	1952	1952
	June	May	June	June	January-June
Complete aircraft	396	417	335	2,265	1,615
By weight of aircraft					
Under 3,000 lb.	236	254	219	1,181	1,436
3,000 lb. and over	33	33	18	132	349
By number of places					
1- to 4-place	356	354	299	1,111	1,465
More than 4-place	23	23	36	132	350
By total rated hp. all engines					
Up to 200 hp.	316	304	269	1,110	1,465
400 hp. and over	23	33	36	132	350
Total value of complete aircraft and parts (000 omitted)	\$58,771	\$54,445	\$21,504	\$136,563	\$151,540
Aircraft total	20,763	17,422	14,440	100,232	87,537
Engine parts	7,738	7,403	6,844	46,329	34,532
Total value of aircraft engines and parts (000 omitted)	\$13,668	\$12,473	\$12,181	\$79,505	\$76,226
Aircraft engines	4,656	4,537	3,766	29,176	22,277
Engine parts	6,425	5,936	5,825	42,110	31,949

Civil Plane Shipments Drop 19%

Civil aircraft manufacturers shipped 179 planes valued at \$21 million during June, a 19% drop from the 220 aircraft valued at \$26.5 million, a 25% increase over May shipments.

• **First-Hold Totals**—For the first six months of 1952, the industry shipped 2,265 civil aircraft totaling 4,974,603 lb. valued at \$207.3 million. In the same period of 1951, the industry shipped 345.5 million a total of aircraft.

Engines shipped during the first half of 1952 increased 31% in number, 19% in horsepower and 25% in value compared to the corresponding period of last year.

from May shipments of 500 engines weighing 391,500 lb.

Value of engines shipped during June was \$6.3 million, a 25% increase over May shipments.

• **Engines Increase**—Civil aircraft engine shipments totaled \$24, adding up to 480,600 hp. This is an increase of 31% in number and 25% in horsepower

Skydrol is the only fire-resistant hydraulic fluid being used by commercial airlines in hydraulic systems, cabin emergency evacuation, or both. Skydrol is the only fire-resistant fluid which can be used in all hydraulically operated aircraft systems.



TECHNICAL FACTS on Skydrol specifications and test data are contained in this 24-page illustrated engineering report. Write us for your copy: Monsanto Chemical Company, Organic Chemicals Division, 600 North Tenth Blvd., St. Louis 1, Missouri.

Circle 10 on Reader Service



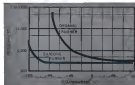
USE THE INDUSTRY WHICH SERVES INDUSTRY



REMARKABLE DESIGN NEW SILICONE DEMONSTRATED BY TEST...



High temperature resistance: 1500°F temperature heat has appreciable effect on the 1000-1300 psi dry gel strength of glass cloth coated with SE-100.



Flexion at -120°F: A glass of the size shown shows lost effective flexing modulus in (below) SE-550 versus original rubber (above).



Compression set: Same-size pieces of ordinary rubber and SE-360 are presented for 24 hrs. at 300°F. Only new SE-360 (right) shows back to original size.

SE-100—IDEAL FOR ELECTRICAL AND MECHANICAL APPLICATIONS!

General Electric's new silicone rubber coating compound, SE-100, combines outstanding heat resistance, electrical and physical properties for a wide variety of electrical and mechanical applications. SE-100 may be coated on glass or organic fabrics for service at high or low temperatures or whose resistance to weather, ozone, corona or chemicals is required.

SE-550—STILL FLEXIBLE AFTER 24 HOURS AT -120°F!

G.E.'s new extreme low-temperature silicone rubber, SE-550, combines high strength and elongation with maximum low-temperature usefulness. SE-550 shows practically no increase in modulus at -100°F and retains useful flexibility at -130°F. This flexibility is achieved without sacrifice of high-temperature resistance or any of the other desirable properties inherent in silicone rubber.

SE-360—MORE "COME BACK" THAN ANY KNOWN RUBBER!

G.E.'s new low compression set silicone rubber, SE-360, is designed to provide more positive sealing action in parts subject to compression at elevated temperatures. In addition to its outstanding low compression set, SE-360 has unusually low shrinkage when cured. This means parts with more uniform properties, closer tolerances and opportunities for your fabricator to cut scrap loss.

POSSIBILITIES OF THREE GREAT RUBBER COMPOUNDS CONFIRMED BY APPLICATION



G.E.'s SE-100 silicone rubber is finding steadily increasing application in the electrical industry for coating coils, tapes and sleeving; for coating glass-surround wire; for encapsulating coils. Among the many mechanical uses for SE-100 are diaphragms and tubing, gaskets and seals, diaphragms.



Gaskets for emergency hatches (shown here at 30 below zero F) were dimes not screws windows on the Douglas Gloster aircraft are now made of G.E.'s SE-350 silicone rubber because it remains flexible and maintains a seal at extremely low temperatures; does not stick to metal after long inactivity.



O-rings, gaskets and seals are being designed with G.E.'s new SE-360 silicone rubber for applications where sustained resistance at high temperatures is required. Also, G.E. automotive and railway design engineers find SE-360 ideal for piston rings, pistons, valves and Diesel pistons.

FOR MORE INFORMATION

about these new G.E. silicone rubber compounds just send the coupon! You will also receive a free copy of "Engineering with Silicone Rubber" which describes other G.E. silicone rubber products and tells how you can put them to work.

You can put your confidence in...

GENERAL ELECTRIC

CLIP AND MAIL TODAY!



- General Electric Company
- Section 3111-44
- Waterford, New York

Please send me product data on: ☐ SE-100
☐ SE-550 ☐ SE-360, including a free copy of "Engineering with Silicone Rubber"
☐ I enclose \$1.00 for SE-360 product data only ☐ An immediate reply please

Name

Firm

Street

City Zone State

By (In Canada, mail to General Electric Canada, Limited, Toronto)

AERONAUTICAL ENGINEERING

At Edwards and Holloman AFB . . .

AF Gets Highspeed Data From Supersonic Sleds

By David A. Anderton

The world's fastest scheduled railroad serves one operator: the U. S. Air Force. These railroads also are the shortest and straightest and have more straight feet length of rail than any one railroad anywhere in miles of road service. They run the only scheduled-profile passenger service in the world.

USAF's railroads are the three test tracks operated by the Holloman Air Development Center and the Air Force Flight Test Center.

► **Research Trains**—Originally planned as launching tracks for the first piloted aircraft, the rails have been used for a wide variety of research tests.

Typical examples of new jobs include:

- **Long and continuing series of aerodynamic experiments** conducted by and on Lt. Col. John T. Stapp and other volunteers to determine the stress limit of the human body.
- **Full-scale tail sections** have been tested for aerodynamic flutter.
- **Smaller models** have been tested for

lift and drag characteristics at near speed.

► **Ejection seats** have been blasted into the air from special test cars moving down the track at near nose speeds.

► **Parachute deployment** has been checked and improved through tests made on these railroads.

► **Complementary Tests**—These, too, are used to test anything that requires high acceleration, high deceleration and transient speeds.

The railroads are complementary tests to wind-tunnel work. They have one great advantage over a wind-tunnel: friction of the model does not wipe out the test facility.

Two of the test tracks are located at the Air Force Flight Test Center, Edwards AFB, Calif.

► **A 2,000-ft. deceleration track** used primarily for crash investigation and human factors research.

► **A 10,000-ft. track** used for a variety of high-speed tests under low air conditions.

The third track is at Holloman Air Development Center and is a 3,600-ft.

test facility used for a large variety of special projects.

Edwards Tracks

Operating at opposite purposes, the Edwards tracks are located at separate ends of Rogers Dry Lake. North of the lake is the 2,000-ft. deceleration track; south of it is the 10,000-ft. high-speed railroad.

► **Chromatite Slabs**—Richard E. Hinson, technical director of the Flight Test Center, and the track facilities are very useful, although they have not yet proved themselves aerodynamically.

Slight misalignments in the track produce acceleration forces that add error to the quantities being measured. Each test vehicle and track combination adds its own characteristic "attitude" to any test. Hence, each of the test center gets 300 runs per year on the high-speed track, engineers consider that they are doing very well.

► **Launching Experiments**—The Engineering Branch of Northrup Aircraft, Inc., can be credited with much of the development of the two railroads at



PARACHUTE DEPLOYMENT test by Cook Research Labs at Edwards checks means of slowing test vehicles in their emergency.



TRACK for model launching at Holloman AFB



EJECTION SEAT is blown from rocket sled at Edwards AFB test



IN DECELERATION TESTS such as this one at Edwards, Lt. Col. John T. Stapp hit a deceleration rate of change of 3,200G/cm.

Edwards. Northrup became interested in track operations during the war by building rocket-propelled sleds that were used to launch a series of pulsed rockets built for the Air Force.

The first sleds largely were made of aluminum alloy tubing with magnesium rods carrying magnesium flippers, which flared over the rail and held the sled on the track.

These sled launching experiments were the forerunners of the high-speed tests made today. Northrup engineers assumed that such a vehicle might be used for transonic aerodynamic tests that could not be made in a fluid tunnel.

► **First Launches**—First aerodynamic tests were performed on the 2,000-ft. track. One of the model launching sleds was modified with a boom to hold a small model vehicle ahead of the sled. This crude vehicle roared down the track at

faster than sound speed in September 1946.

The sled was considered expendable. At the end of the track it left the rails and bounced over the desert for hundreds of yards, shattering into bits and pieces as it rolled. The track was too short for the sled to accelerate to such high speeds and halt within a reasonable distance.

But engineers learned enough from these first runs to realize that a 10,000-ft. track would be long enough to get the speed required and to stop the test vehicle before it ran out of track.

► **Rocket Propelled**—So the Northrup team turned its efforts to design and construction of the 10,000-ft. track and special rocket-propelled vehicles, all built to Air Force specifications and under USAF sponsorship.

During the initial stages of the project, they received several setbacks. Typ-

ical of these were the reactions of rolling mills personnel and railroad construction contractors. They were asked to supply rail and lay track that would be accurate within 1/16 of an inch in 100 ft. of track. They felt that perhaps 1/2 inches the specified tolerance would be a reasonable value.

► **Northrup Builds Railroad**—Northrup finally decided to do the job itself. As an aircraft company constructed a rail road.

Rails were laid and lined up during the night to avoid distortion from expansion and contraction caused by the sun's heat.

Both tracks were laid out to standard railroad gauge (4 ft. 8 1/2 inches between rails), and the steel rails were clamped to a continuous concrete beam poured deep into the soil.

► **Vehicle Design**—The sleds that ride the 2,000-ft. deceleration track are of



In the Stratosphere
or Scoping Tree-Tops...
DOUGLAS RB66A Gets
DEPENDABLE SWITCHING
with **NEW** Hermetically-Sealed



LIMIT SWITCHES

Claimed to be one of the most versatile photo-reconnaissance planes ever designed, the U.S.A.F. twin jet RB 66A, above, is built by Douglas to operate in the stratosphere or to scope tree-tops in low level missions. Electro-Snap Hermetically-Sealed Limit Switches are used in this aircraft because only they have the operating versatility to match that of the RB 66A. Hermetically-sealed to make them *environment free*, Electro-Snap Limit Switches perform equally well at any altitude, in any weather or humidity condition and at any temperature.

Also for Industrial Use

Industrial models of the hermetically-sealed switch are available to give industrial designers the same superior performance aircraft designers are getting. Electro-Snap Hermetically-Sealed Limit Switches can be used anywhere for dependable control of automatic sequence movements, safety interlocks, positioning and limiting movement of machine members.

For additional information send coupon or write to Electro-Snap Switch and Mfg. Company, 4236 West Lake Street, Chicago 34, Illinois.



PRECISION SWITCHES
FOR AIRCRAFT AND INDUSTRIAL USE





Standard Limit Switch Sub-Miniature Limit Switch Modular Limit Switch

the Environment Free SWITCH

• Dependable Anywhere

ALL PARTS HERMETICALLY-SEALED

Only Electro-Snap Limit Switches have all of the electrical mechanisms hermetically-sealed in a dry, inert gas. This complete sealing excludes Electro-Snap switches from fumes, corrosion, accumulation of dust on the contacts, oil intrusion, surging, or misalignment and explosion-proof.

LONG LIFE—RATED AT 2 MILLION MECHANICAL CYCLES

NO MOISTURE CAN GET IN
TO CONDENSE OR FREEZE
ICE CAN'T JAM—THERE ARE
NO SLIDING PARTS

UNAFFECTED BY HEAT OR COLD
RUGGED CASE—EASILY MOUNTED
LIGHT AND COMPACT

Switch weighs 30 lbs., has outside dimensions of approximately 2 1/2" x 1 1/2" x 3 1/2" (exclusive of actuator lever). A variety of actuator and mounting methods are available.

MANY CIRCUITS

Furnished in all circuit variations of S.P.D.T. and D.P.D.T. switching action.



An industrial model of the Electro-Snap Hermetically-Sealed Limit Switch protects drills worth hundreds of dollars on automatic drilling machines above. Only location for switch beneath hydraulic cylinder (shown) other switches to start and end more work in working sequence. Switch-high drill breakings. This trouble has been completely eliminated by use of Electro-Snap Hermetically-Sealed Limit Switch.



TYPICAL INDUSTRIAL APPLICATIONS

- ON MACHINES where contact, oil or splashing causes other switches to fail
- BOTTLING OR BLENDED — for conveyor operations where splashes cause shorts
- IN REFRIGERATION INSTALLATIONS as intensive, interlock or control switch
- IN LAUNDRIES where humidity and heat causes switching trouble
- IN CORROSIVE ATMOSPHERE
- ON DRIVERS, FURNACES, HEATERS, ETC

ELECTRO-SNAP SWITCH AND MFG. COMPANY

4236 West Lake Street
Chicago 34, Illinois

Please send data sheet with complete information about ELECTRO-SNAP Hermetically-Sealed Limit Switches to:

Name _____

Company _____

Title _____

Street _____

City _____ State _____ Zip _____



where a leakproof joint is required . . . we recommend

PASTUSHIN FLUID-TIGHT Rivets



says

BRANIFF International AIRWAYS

"We use Pastushin FLUID-TIGHT rivets for most repairs to obtain good sealing qualities," says C. G. Boyette, Branch Chief, Maintenance Department. "We recommend them for problems in sealing fuel tanks where leak-proof joints are required."

Usually, like many other aircraft and aircraft manufacturers have discovered that Pastushin FLUID-TIGHT rivets give maintenance men better and do a better job. They're also strong, permanent and don't leak.

Pastushin FLUID-TIGHT rivets are fully approved by Air Force, Navy and C.A.A.

ADVANTAGES

- Completely leak
- Easy to install
- Pull rivet strength
- Reusable standard
- All rivets without loss of joint efficiency
- Use on conventional riveting tools and methods
- All tests and checks available



Write for full
information
and
catalog #12



**PASTUSHIN
INDUSTRIES, INC.**
201 Pierce Avenue
Pasadena, Calif.
91106-0270

steel construction and appearance. There is no typical sled to duplicate the design for the principle test.

Common feature is rocket propulsion. Solid-propellant rockets are used as multiple units to produce the thrust needed for the test.

► **Baking System.**—The test crew is satisfied with relatively low speeds for that particular track. Maximum sled velocity is 250 ft. per second.

After the brief burning period of the rockets, the sled begins to decelerate because of friction between the magnesium slippers and the rail. It attains the brake at about 250 ft. per second.

The brake is located 1,250 ft. from the end of the track, and is approximately 90 ft. long. There are 40 spaced blades in the 90-ft. length. Actuated hydraulically and brought to higher pressure with nitrogen, the blades keep braking loads on the bottom of the sled. The track extends over 12,000 ft. The sled extends over 12,000 ft. The sled extends over 12,000 ft. The sled extends over 12,000 ft.

► **Accelerating Gas Principles.**—Depending on the deceleration, the velocity with which the sled leaves the brakes may vary by a maximum of about 120 ft. per second.

A cable, stretched across the track near the entrance end, acts as the final brake for the test sled. This works along the ground lines of an aircraft carrier arresting gear, the cable is wound on hydraulically loaded reels on each side of the track.

The sled is stopped by cable tension applied through the hydraulic reels.

The braking portion of the track is located between the control building and the instrument building.

► **Recording.**—Tests—A concrete slab has provisions for four cameras to photograph the test subject. Just beyond the track is an eight-foot high guy plywood backdrop that serves as a backdrop for the photography.

Lenses on the subject are measured by four microcameras that transmit their information to recording equipment. These latter cameras are used to record distance velocity, rate of G building and exit velocity. Distance gauges on lead blocks also can be used to measure loads.

The space-time recording system uses a permanent magnet attached to the sled to actuate coils on each of the lenses mounted along the track. Current generated in the coil flashes a neon bulb, and lighting of neon bulbs is recorded by high-speed cameras.

► **300G Deceleration.**—An on-board and suspended strain gages are used to produce decelerations that begin at the maximum level of the track and increase to 300G.

This track mounts a special sled sled by a gas line the standard USAF spec



LT. COL. STAFF (r) discusses deceleration test with George Nichols of Northrop.

test sled. The test carriage is loaded hydraulically, which produces decelerations from 100 to 300G.

Further tests were made by letting a wing-shaped portion of the seat air pump on a lead cone end, on the maximum deceleration from 50 to 300G could be produced.

► **1,000-mph Track.**—Robert King, civilian head of the track branch, explains the novel method of construction of the 10,000-ft facility.

Foundation of the track is a continuous reinforced concrete beam with an inverted T-section steel beam on top. The top of the T—slightly above the top of the concrete. The steel rails are bolted to the T—with a system of bolts that permits vertical and lateral adjustment for alignment of the tracks.

"We test just about anything on this track," said King. "We've run seat ejection tests, parachute recovery systems, pressurized crash location systems, acceleration filter, some structural work and even acceleration tests on missile guidance."

Speeds obtained on the track are supersonic, about 1,000 mph.

► **Sled "Bare Yard"**—As on the 2,000-ft track, there is a "bare yard," and a "bare yard" of sled sled shows the extreme variety of designs. One developed by Cook Research looks like a mobile kit, another, for ejection seat studies, is like a rocket.

A light yellow sled occupies a large frame with four struts in a vertical plane. This is a pulley sled with three 47,000 lb. solid-propellant rockets as a powerplant. The sled is the first stage of a two-stage system, it carries the sled back to the test sled sled. After the rockets on the first stage have burned out, the sled is stopped by air brakes.

► **Liquid Propellant.**—King said liquid propellant rockets are coming into use now—5 ft. in size—operating on the track, on order and another expected to run in a few months.

The fuel system is, undoubtedly, be-

cause, the cost of liquid propellant for a test is approximately 1/5 that of solid propellant for the same sled speed.

► **Water Brake.**—One of the big research programs underway on this track was the development of a water brake to slow the sled from its extreme velocity of more than Mach 1 to a complete halt.

Original water scooped in water from a channel between the rails and, by having it 180 deg. in the vertical plane, stopped the sled by transfer of momentum. But trapping the water vertically produced negative subatmospheric voided back, too, posing to catch the test group. At a result, they had gone to lateral housing of the water.

Water braking is extremely effective. The current "bare" brake is coupled and, in section, looks like a rotating frame of a wing strut. The water will stop at test sled from an initial speed of 850 mph to a dead halt in several hundred feet. This is even more remarkable considering that the submerged area of the brake during a test is only 6/100th of a square inch.

► **Space-Time Curve.**—Only 400 ft.



SEAT EJECTION takes place at speeds up to 1,000 mph in Edwards tests.



ROCKET SLED built by Northrop. Shovel pulls and in photographic instrumentation.

responsibility

A Cooper rough letter, that inspection quality in the rough, continuous work many steps all of which are performed by Cooper is an undeniable responsibility.



Cooper's rough letter, that inspection quality in the rough, continuous work many steps all of which are performed by Cooper is an undeniable responsibility.



COOPER is the name of the company that makes the rough letter.

COOPER

COOPER is the name of the company that makes the rough letter.

COOPER is the name of the company that makes the rough letter.



SLRD positioned for static test at AFTTC. Model is mounted on base, top left.

along the track, is an auto-orientation position, feeding data into a 20-gate cable lead under the track to the block house. On the test sled track, a 36-channel television system sends no intelligence to a beam receiving station.

The space-time curve for the sled is developed from data furnished by the coil and pressure magnet system used on the 2,000-ft track.

An alarm used at one side of the track runs part a row of lighted markers on 36 portable transom lenses toward the water bank.

A steel girder near the end of the track. "This is not unusual," King said. "A runway line comes down every morning to drink out of the brake."

Holloman Track

Younger brother of other test tracks in the United States, the sister rail at Holloman was designed for aircraft hangars. That work today lives a large portion of the track's program.

But other projects—pneumatic tests, test questions and some auto-orientation work—occupy the track at different times.

► **Block 2 Design**—It is a wide track, laid out in a 7-ft gauge and is 1,000 ft. long. Track accuracy 1/32 inch in 10 ft.

Design speed capability of the track is Mach 2.4 or better. Acceleration and deceleration currently is limited to plus or minus 5G, but the Block Track Branch at Holloman is planning to boost that figure to 30G.

► **Beaking Tests**—When beaking is used, by installing a brake at each end of the track, tests can be fired and decelerated in either direction.

In contrast to the continuous chain of varying depths used at Edwards on the 10,000-ft track, water banks at Holloman have depth regulated by a series of dams placed about 25 ft apart. These dams, which are ordinary Masonite board, stop the water depth from shallow to deep and regulate the deceleration g-forces in the brake. The

dams are ripped out in the brake passes through them.

► **Control Center**—The block house where instrumentation and control of the track are located is a cool, windowless concrete room. A long ramp leads to well below ground level and through a heavy steel door.

Straight ahead is a 20-ft wide passage of the track that appears on the lower end of a large periscope aimed through picture windows in the block house. In front of this passage are control desks from which the tests are controlled.

"We're using solid propellant motor for our sleds now," said Capt. Robert Buchanan, "but we understand that the test is definitely to liquid fuel rockets, which are considerably less expensive than solid."

Buchanan is track operator at most of a problem here than it is at Edwards. Buchanan and the maximum vertical G due to slugs doesn't exceed 6 ft.

He said the end of the track is a standard steel section, but it is a special run instead of the magnesium clippers used on the tracks at Edwards, the slippers of the Holloman sleds are faced with sapphire.

► **Slam System**—Space-time data is furnished on the track by the Slam system developed by Max Rothman of the research test branch. This end test measures sled positions in 1/10 of an inch and time to microseconds.

Rothman quoted a typical accuracy for the measurements at a speed of 1,000 ft per second and a sled acceleration of 10G; the velocity will be accurate within one ft per second and the acceleration within 1G.

The Slam system mounts a series of capacitors along a track, attached to electrical switches that normally are open. The activating element for these switches is a radio field.

The sled mounts a radio-frequency projector operating at 65 megacycles. It projects a field bubble with infinite slope, the field waves front turns from nose to rearward radius in less than 1/100 of an inch.

As the R.F. projects pass the coils built within a distance of about two-tenths of an inch, the field causes the wave field, which discharges the attached capacitor into a current conductor running to the block house. Recording instrumentation in the block house transmits the signals into the space-time relationship for the test.

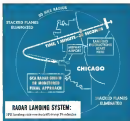


LEADS top to Col. Stapp transmit story of body's response to deceleration.

Gilfillan Radar Traffic Control Saves Airlines \$100,000 in One Month's Operation at Chicago's Busy Midway Airport



OLD LANDING SYSTEM: 100 landings per hour at 10-minute intervals.



RADAR LANDING SYSTEM: 100 landings per hour at 10-minute intervals.

Formerly, aircraft flew over airport for orientation, circled in to landing beam—a system resulting in aircraft "stacking" delays. Today, Gilfillan Radar guides aircraft direct from 30 miles out to touchdown.

"Delay in landing or losses at Midway airport on bad weather have been virtually eliminated since the extended use of radar aids by the airport's air traffic controller team, often cited as best in the nation," writes Wayne Thomas, Aviation Editor of the Chicago Tribune.

In December, 1953, without radar control, aircraft lost 235 hours 58 minutes flight time waiting over radio "holding points." In January, 1954, with radar traffic control "holding time" was reduced to 4 hours 30 minutes. Weather conditions during the two months were almost exactly comparable.

"As a result," writes Mr. Thomas, "airlines saved \$100,000 in five one month, increased schedule reliability and passenger satisfaction, increased safety in Chicago's high density traffic."

Today, incoming aircraft are paced up by G400 Air Surveillance Radar (ASR-1) 30 miles out.

guided to final approach zone. Then, Gilfillan GCA Radar (PAR-1) takes over, guides or monitors final approach.

During several peak traffic periods, a new record for civil airports was set by landing as many as 18 aircraft in a 15-minute period.

Bob Ziegler, Chicago District CAA Supervisor, commented that excellent use of Gilfillan ASR-1 and PAR-1, for traffic control as well as landings, increased safety by preventing aircraft position in a 30-mile radius and achieving positive 3-mile separation between aircraft. Gilfillan Radar also allows FFI landings on any runway at the airport. The FFI landing was also pioneered at Chicago. Could gain to CAA, the Midway Traffic Controller Team used the Airlines Pilots who participated in the six months experimental period that perfected radar traffic control at this busy airport.

In GCA, Radar and Electronic Research, Design and Production...

the FIRST name in... **Gilfillan** RESEARCH **GCA**

Los Angeles

AIRCRAFT FASTENERS BY **SPS**



For complete information, write SPS, Jacksonville, FL 32202.

AIRCRAFT PRODUCTS DIVISION

SPS

[BROWSE BY CATEGORY](#)
[CONTACT US](#)

USAF CONTRACTS

Following is a list of recent USAF contracts awarded by Air Materiel Command:

Forest Products Div., Ford-Worner Corp.,
Eastland Ohio 44022 2247, Jan. 22, 1974.125.
Rene Hubert Van der - 14119 John E. St.
Troy Mich. 48060. almost 400000
wt. on 14119

Sylvania Electric Co., 371 4th Avenue N.
 New York, N. Y. 10018-4400 484-8117
 General Electric Co., 100 Avenue M
 EL PASO, TEXAS, 79967 748-4000

Longview Paper Co., 12000 Foothill Highway
Van Nuys, Calif. 91411
Call 818-708-1000, ext. 2000
Fax 818-708-1000, ext. 2000
E-mail: info@longviewpaper.com

Sperry Gyroscopic Co., Inc., Potomac City
Grove, N. Y., E4 4010400 18-
034 110

Enclen: Has C&A Corp. Model 140 Two-Chl. 49479 parts, 2 ea. —(6) \$11.00

88 W. Madison St. 4th, 241 W. Madison St.
Address: 98400, 98400, 98400, 98400
gross income: 110000, 110000, 98400, 98400

[illegible]

Special Machines & Tool Co., 3501 1st Ave.
St. Louis, Mo. 63103

Aluminum Manufacturing Corp., 2200
Crawford St., Cleveland, Ohio 44115

Air Products, Inc., P. O. Box 444, Allentown, Pa. 18106-0444. Tel. 610/262-1000.

Aluminum Engine Service, Inc., Miami, Fla.
 10000 W. Dixie Hwy., Suite 100, Miami, Fla. 33157

Alcoa Products Co., Church St. &
Crested Lake, Michigan, Edgemont, Pa.

Amorpha canescens Des., 40 p. 30 cm. fl.

Associated Machine & Metals, Inc. United

American Optical Co., Southfield, Mich., 313-761-1000.

12" Square Grid, 84 in. 12" Square Grid 84 in.



CHECKS FOR SETPAGE

Torque at which the shaft of screw drivers will slip can be determined in the field with this torque tester. It is operated by engaging test shaft with that of concern and turning knurled check with finger until slipage occurs. Readings are taken off the scale, graduated in 2500-ccmiflexure increments, up to 40 gram-milliflexure. Scaled for checking light speed and torque springs, it can be used in almost any capacity by changing calibrated spring within unit. The tool was developed in use at Babcock Corp. of America, aircraft engine plant, by John Charlton & Son, at Clark St., New York 16.



SEEING IS BELIEVING

Supplying the right answers to pilots and navigators by means of accurate, reliable instruments has been our work for more than twenty-four years.

- ✕ AIRCRAFT INSTRUMENTS AND CONTROLS
- ✕ OPTICAL PARTS AND SERVICES
- ✕ SIMULATED AC MOTORS
- ✕ RADIO COMMUNICATIONS AND NAVIGATION EQUIPMENT

Current production is largely devoted to our defense issues, but our research facilities, our skills and talent, are available to scientists seeking solutions to instrumentation and control problems.

**kollsman** INSTRUMENT CORP.

STANDARD, NEW YORK, NEWARK, SPRINGFIELD, DIVISION OF *Standard* OIL PRODUCTS CO., INC.

"Golden Year" Cessna 170

AMERICA'S MOST VERSATILE,
LOW-COST PLANE



TYPICAL CESSNA 170 SEAT: Two passengers, seven cups each holding 30 complete meals. Total weight: 545 lbs.

From Four-Place Luxury Ship to Two Passengers Plus Cargo

...IN JUST 6 MINUTES, 37 SECONDS!



TO REMOVE THE REAR SEAT
all you need is a screwdriver and a wrench.



FRONT UNHOOK 3 SEATS
hooked at the front of the seat.



NEXT, REMOVE SINGLE BOLT
hooked at the rear of the seat.



AND IN LESS THAN 7 MINUTES,
the seat is out, cabin is ready for cargo.

There's a quick-change seat that's adaptable to any business equipment! The luxurious Cessna 170 carries 4 passengers in cozy comfort... or, it's a heavy-duty hauler, capable of speeding a quantity of cargo to destination. The Cessna 170 can be fitted with skis, floats or cross-wheel wheels, adapted for ambulance work, aerial photography, crop-spraying or blood-flight instruction. AND, IT'S AMERICA'S LOWEST PRICED, 4-PLACE, ALL-METAL PLANE BY SEVERAL THOUSAND DOLLARS!

For additional information, write Cessna as your company letterhead or mail coupon today.

Cessna Aircraft Company
Box 4009
Wichita, Kansas

Name and title on this new "Golden Year" Cessna 170: _____
City: _____ State: _____
Phone: _____
Address: _____
Daytime: _____
Evening: _____
(To receive manual, please fill out coupon accurately.)
SEND \$10.00 TO BUY CESSNA 170 AND CESSNA 170B
CROSS-WHEEL MODEL.

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Are you looking for a new plane? Or a new way to make money? Or a new way to make money?

Nozzles for JETS



THIS IS ONE
of many Stainless
Steel nozzle assem-
blies built by Ex-Cell-
O Corporation, one of
the world's largest
producers of aircraft
precision parts.

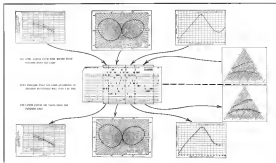
There's something of Ex-Cell-O in practically every plane made in the U.S.A. today.

Illustrated are typical blades, nozzles, hydraulic actuating assemblies and fuel control assemblies, precision built by Ex-Cell-O Corporation to aircraft builders' rigid specifications.



EX-CELL-O CORPORATION DETROIT 32, MICH.

MANUFACTURERS OF PRECISION MACHINING TOOLS • FERTING TOOLS • BURNING PINS AND REPAIRS
USED ON AIRCRAFT • AIRCRAFT AND MISSILE PARTS PROTECTION PARTS • SHORT EQUIPMENT



PERFORMANCE CURVES can be recorded on and reproduced to meet any desired degree of accuracy from punch cards.

AF Beacon to Light Up Avionics Maze

New information center will answer equipment designers' questions on the availability and application of components.

By Philip Klass

Darting—The advent of static and regenerative aircraft and missiles has outstripped equipment engineers' knowledge for components capable of operating in more rugged environments than before. The search is underway for lighter and smaller, yet more rugged, components that will enable them to increase the operating temperature, altitude and resistance to vibration of their equipment, or to make it smaller or lighter.

►The Need—New components keep piling up, to a great extent, with new demands that for engineers and designers to keep tabs on component developments is not easy. Hundreds of new components have entered the field and new ones are coming in daily.

This cataloged component industry is spawning new developments so rapidly that a few of the larger equipment manufacturers have set up groups of specialists solely to keep tabs on and

coordinate new components. But even this does not offer positive assurance that all new component developments will be known to an equipment manufacturer.

►Information Center—To help direct avionics designers toward the state of the art developments, Air Force has today the first step to set up a major information center in which automatic push-out card machines will provide complete, accurate, and speedy answers to questions on availability and application.

The clearing house is called Electronic Components Information Center (ECIC). It is the result of a two-year study program at the Ballistic Missile Research, Columbus, Ohio, sponsored by the Electronics Component Lab of the Wright Air Development Center, Air Research and Development Command.

ECIC is going into pilot operation soon at Ballistic Missile Institute to provide information on fixed resistors

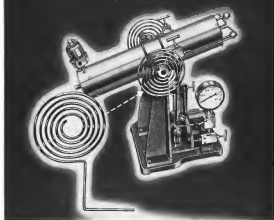
Externally WADC hopes to expand ECIC's operations to encompass manufacturers of different types of components, from resistors to vacuum tubes, from electronic tubes to semiconductors.

►Abnormal Settings—Like the products of them and its workers find, it is the component with the lowest resistance operating temperature that determines the maximum operating temperature of an entire avionics equipment.

In order to be able to operate a component at temperature (or volt-ages, as present) considerably beyond its rated value, an engineer designing equipment for a missile, jet or jet, may be willing to accept shorter component life.

Or, to achieve extremely long and reliable equipment life, the designer can resort to derate components, using them at less than rated temperature, voltage, or power. In either case the equipment engineer needs to know the relationship between component life

Windpipe for a peaceful H-bomb



You may call it a windpipe if you like. Some people do. Technicians, it is a hydrogen bomb or simply a super pressure wind. One for it is not known but not unlike. Researchers in rubber, plastic, phosphor, and other materials, and others plot their hydrogenation test results, polymers, and other gas breaker problems in its wind—under high pressure.

To speed up chemical reactions, the wind is reduced 38 times a minute. This means a test chamber is in a well a test tube whose pressure of the order of 60,000 psi is acquired via a light beam (discovered) or a resistor.

American Instrument Company, Inc., maker of pressure equipment, introduced the pressure through a

spiral windpipe. They had come through the tube through but that was before they had Superior 304 Cold drawn Stainless Steel Tubing. Superior gives them just the flexibility and fatigue strength needed for cyclic operation—plus chemical resistance and burst pressure in super. Samples of Superior 304 are under the hand, but longer. And American Instrument reports them dimensionally uniform (smooth) and free from surface imperfections.

If you have a bend or small tubing in the analysis, size, and don't you want, or if you think there's little difference in tubing or tubing experience, Superior serves your inquiry. Superior Tube Company, 2040 Germantown Avenue, Skaneateles, New York 13152.

Standard and Shaped Tubing available in Carbon, Alloy, and Stainless Steel; Nickel and Nickel Alloy; Titanium, Zirconium, and Beryllium Copper

Superior

1 1/2" to 14" IN. DIAM. IN. WALL THICKNESS

AR analysis 99.99% to 99.99% B.A.
Certain analysis (99.99% min. wall) up to 316% B.A.

West Coast Fabric Tube Company, 2010 Cortright St., Los Angeles 25, Calif. UNCLAS 0-1331



Built to get there NOW!

**F-94C Starfire combines
defense with economy!**

No fighter-interceptor can get into the air quicker, and none can climb faster than the Lockheed F-94C Starfire. This new all-weather interceptor for the U.S. Air Force is now defending key American cities from possible air attack. The Starfire was designed to reach target altitude in record time.

Combining greater flight availability and lower maintenance costs with superior performance, the F-94C Starfire seriously delivers more defense for your dollar.

Lockheed

AIRCRAFT CORPORATION

BIRMINGHAM, CALIFORNIA AND JACKSONVILLE, GEORGIA

Look to Lockheed for Leadership



Lockheed

**Builds Plane No. 25,000
and Jet No. 5,000**

Lockheed airplane Number 25,000 rolled off the production line recently at Lockheed's Burbank, California, plant Significantly, it was an F-94C Starfire Jet Interceptor, newest member of Lockheed's growing jet aircraft family Later, another Lockheed Starfire became the 5,000th Lockheed jet to be built.

There's a reason for the quality production of F-94C Starfires. Here's a military jet that does an outstanding job and saves money, too.

Here's How It Does It

Economy is important with the Air Force, and here's how the Starfire helps on the budget:

An economical airplane is one that performs its mission with greatest efficiency and offers maximum availability on the ready line. Maximum time between overhauls means lower maintenance costs. More important, it means fewer planes are needed. The U.S. Air Force provides both types of economy with the Starfire.

2-Man Team Helps

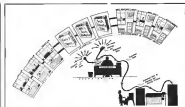
Since the Lockheed Starfire is a 2-place interceptor, it affords the cooperative efficiency of a 2-man team to manage the tactical problem and perform all other eight-second operations of intercepting an enemy at 600 mph plus speeds.

This all-weather interceptor is equipped with automatic electronic controls — Hughes Radar System, Westinghouse Automatic Pilot, Sperry Zero Reader and other advanced devices, making it very nearly an automatic airplane.

A "Pilot's Airplane"

Reports coming in from the field indicate that Lockheed has again produced a "pilot's airplane." Air Force pilots like the Starfire and like to fly it. They find it simple to fly and cock steady under actual combat conditions.

Here is the happy combination of 4 important factors in one reliable airplane: (1) Superior performance — (2) Easy maintenance — (3) Pilot popularity — (4) More defense for your dollar.



EVALUATION and change of component data is illustrated by flow chart.

and its operating conditions.

In the past the standard rating to determine has not been precisely available from component manufacturers and had to be established by individual equipment designers after extensive testing.

It is little wonder that a WADC spokesman has said: "It is estimated by design engineers of large electronic organizations that design life is 40% of the time necessary to design electronic equipment would be used if there were available a quick and accurate means of information on the engineering characteristics of heat electronic components."

► **ECIC Advantages**—The Electronic Components Information Center, as previously mentioned, appears to be able to solve these problems. Here are some of its advantages:

► **Single source of component data** for equipment designers, saving a search of many sources is now required.

► **Centralized pool** to which all sources of data on component performance can send their information for widest possible dissemination.

► **Rapid replies** to requests for information (in 24 hours or less) through the use of automatic data handling machines.

► **Organizing ECIC**—One key to the success of ECIC is the use of data from many manufacturers which allow the information center to store a vast amount of data and make it rapidly available through its files to produce the required answer quickly.

In the course of this study, Battelle and WADC had first to determine all possible types of data that electronic equipment engineers might need for a variety of different components. Then it was necessary to develop techniques for storing such information efficiently as punch cards to permit speedy recovery when needed.

Recording single-valued data, such as a component's dimensions, rating, and manufacturer, is fairly straightforward. However, WADC recognized that ECIC's usefulness would be greatly increased if it could incorporate from several component efforts to give component performance information wide operational operating conditions both in extreme temperature for short service life.

► **Curves on Punch Cards**—This meant that curve type data would have to be recorded on punch cards, giving component performance as a function of its operating conditions. For example, component life as a function of operating temperature, voltage, or load.

Battelle has developed techniques employing standard transparent grids for both linear and non-linear coordinate systems which make it possible to transfer any curve to punch cards. The technique can be applied to curves plotted as Gaussian, polar, or trigonometric coordinates. Any desired degree of accuracy can be obtained, very high accuracy, however, might require use of more than one punch card.

► **Getting the Data**—The accuracy and completeness of the answers which ECIC provides are obviously no better than the data which goes into its punch cards. This means that manufacturers must use standardized test procedures to obtain ECIC data. Wherever possible tests already established in MIL or JAN specs will be used to obtain ECIC data. But some tests upon which call for tests on component life as a function of different operating conditions, Battelle has been known to recommend testing procedures to obtain this type of ECIC data.

WADC and Battelle have recently released a report showing the data which component manufacturers must provide to register their studies of component, carbon-life and wear-wear.

TOMORROW'S AIRCRAFT: *One step closer*

**Human Engineering...
to simplify
airborne systems**

Human Engineering has become a primary factor in the design of Westinghouse Avionics Equipment. Through scientific study and impersonal evaluation of operational problems, the Air Arm Division is using this principle to develop better airborne systems and permit aircrew to perform vital tasks quickly, simply and safely.

This is shown in Westinghouse Fire Control Systems. To make the equipment truly effective, it is necessary to analyze what the operator must perceive, interpret and translate for successful operation. The effects of *seeing* solidifying evasive action must also be considered. Specific Human Engineering studies then indicate the extent of automatic devices, placement and shape of controls, presentation of information, reaction time factors, sequence and method of operation. Such scientific facts, coupled with Air Arm experience, result in optimum compromise between operator's capability and engineering feasibility... and a product designed with all the possible benefits to accomplish the required mission.

This progressive concept of product design comes from Air Arm, a wholly owned Westinghouse Division, devoted to the manufacture of autopilots, airborne radar, complete fire control systems, computers and guided missile components. Complete development, production, flight testing... and now Human Engineering... facilities concentrate specialized capabilities on the problem of bringing more precision, simplicity—and reliability—airborne systems One Step Closer. J21013



A Westinghouse Human Engineered Autopilot is used in the Republic Aviation F-84 Thunderbolt, shown above. At right is close-up of autopilot console, designed with minimum number of controls for maximum simplicity.

THE SCOPE OF WESTINGHOUSE IN AVIATION

Base aircraft systems

Turboprop Engines, Fuel Control, Radar, Autopilots, Communication Equipment and Electrical Systems.

Ground equipment

Wind Tunnels, Airport Lighting, Industrial Plant Apparatus.

Airborne system components

Transformers, Rectifiers, Instruments, Gyro-instruments, Temperature Control Panels, Computing Equipment and Systems, Controls, Circuit Breakers, Com-tacks, Motors, Actuators and Horns, Pitot-static Tubes, Magnets, Relays.

**YOU CAN BE SURE...IF IT'S
Westinghouse**



DEPENDABLE performance DEPENDABLE delivery

— BACKED UP BY

Dependable Engineering

FLEXIBLE CONDUIT

WAVE GUIDES

WIRING HARNESSSES

SPARK PLUG LEADS

JUNCTION BOXES

As manufacturers of shielded ignition equipment for O.E.M. use by the industry's leading engine and airframe builders, our engineers take pride in producing products that far surpass each individual job specification. With offices in all principal cities for immediate liaison and service, we welcome the opportunity to coordinate our design and development staff activities with your needs.



Co-Operative Industries, Inc.

110 CANNAL ROAD, CHICAGO, NEW JERSEY
Manufacturing Offices: Philadelphia, Cleveland, Los Angeles, Dallas,
San Francisco, San Diego, Seattle, St. Louis, Tulsa

type in the ECIC files. This report also describes test procedures which are to be used in obtaining this data and shows the test sheets (forms) on which data is to be used to ECIC for processing into punch cards.

Test procedures and work sheets for other components are expected to follow at a later date, Barnhill says.

Types of Cards.—An ECIC is now planned, there will be three different types of punch cards, each used for a different function. The types are:

• **Application data cards.** These contain detailed technical information for each individual component.

For example, there would be one set of ADCs for a 1,000-ohm, 1-watt, fixed resistor made by Company "X," and another set of ADCs for the company's 2,000-ohm, 1/2-watt resistors, etc.

• **Summary data cards.** These contain abbreviated technical data on groups of components, made by the same manufacturer, which are identical except for their resistance, capacitance, inductance, etc.

For example, one ADC would be prepared for Company "X" for all of its 1-watt composition fixed resistors, showing the range of resistance values available. Another ADC would show all of the company's 1-watt composition fixed resistors, etc.

Object of the ECIC is to save searching through the mass quantities of application data cards, when detailed performance data is not required.

• **Procurement data cards.** These contain general information (such as manufacturer type and part numbers, cost list price) that is particularly useful in the procurement of components.

• **Application Data for Resistor—Series** also of the thoroughness of the ECIC



NEW TRANSISTORS

Westinghouse Electric Corp. has announced availability of two new transistors in single quantities for use in amplifiers, oscillators and switching circuits. The WX 412 (type) is a p-n-p transistor providing a 30-db, power gain when used with a grounded emitter and base circuit. The WX 417 has an 11-db gain and a cutoff frequency of 2 mc when used as a grounded base amplifier under similar signal conditions. Westinghouse Electronic Tube Div., Dept. 7134, Box 234, Broom, N. Y.

system and the operators; it is capable of receiving data to be printed from the following data which will be required for composition, carbon film, and wire-wound fixed resistors.

• **Type of system.** Type of construction and degree of adjustability, classified and coded per ECIC nomenclature.

• **Manufacture.**

• **Specifications.** Identification by code to show which addition or other spec component (units).

• **Resistor value.**

• **Power rating.**

• **Shape.** Identified by code.

• **Dimensions.** (All three dimensions are listed).

• **Volume.**

• **Manufacturer.** (Maximum power rating in watts per cubic inch).

• **Weight.**

• **Terminal type.**

• **Case material.**

• **Protective coating.** (Methods and materials used to protect resistor elements from their external environment).

• **Package.** (Type of terminal used to protect resistor against fungus).

• **Construction.**

• **Minimum and maximum temperature operative.** (The maximum and minimum temperatures which the resistor can be subjected to when not in operation, and then be changed and operated within all specified limits).

• **Maximum and minimum temperature non-operative.** (The maximum and minimum temperatures to which the resistor can be subjected when not in operation, without affecting its performance in its normal operating temperature range).

• **Humidity.** (Indicates whether resistor has passed humidity tests of MIL spec).

• **Altitude.** (Indicates whether resistor has passed barometric altitude tests of MIL spec).

• **Vibration and shock.** (Indicates whether resistor has passed vibration and shock tests of MIL spec).

• **Shock life.** (Length of time that resistor can be stored and still meet all spec requirements).

• **Service life.** (Reporting life in service at rated loads that can be expected under normal operating conditions).

All of the foregoing information can be recorded on a single punch card through the use of special codes.

• **ADC No. 3.**—The second application data card contains the following information:

• **Electrical tolerance.** (Permissible deviation from nominal resistance).

• **Frequency range.** (Within which all nominal ratings of resistor can be met).

• **Temperature coefficient.** (Percentage change in resistance with temperature).

• **Voltage coefficient.** (Percentage change in resistance per volt caused by voltage impressed on resistor).

• **Power dissipation.** (Maximum power generated in the resistor).

• **Current capacitance.** (Permissible capacitance of the resistor).

• **Current inductance.** (Self-inductance of the resistor).

• **Insulation resistance.** (Resistance between outer skin of the resistance and the plated terminals).

• **Resonant frequency.** (Where resistor impedance is a minimum).

• **Element arrangement.** (Identified by code).

• **Number of terminals.**

• **Mounting method.** (Identified by code).

• **Terminal strength.** (Ability of resistor terminals to pass JAN spec tension and tension tests).

• **Temperature rise.** (Maximum surface hot spot temperature which resistor can attain and still remain within ratings).

• **Insulation material.** (Insulation identification of material used to isolate sensitive element from outer surface of resistor).

• **Project coverage.** (Indicates whether or not a development project covering the resistor is in force).

• **Variable Data.**—Resistor characteristics which vary with operating conditions are recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

is recorded in curve form on application data cards No. 3 and 4. This data

New!
CASTER & WHEEL
Catalog

DARNELL



Write for your copy today!

DARNELL CASTERS & E-Z ROLL WHEELS

Always
SWIVEL
and **ROLL**
SAVE EQUIPMENT
SAVE FLOORS
SAVE MONEY
and TIME

DARNELL CORP. INC.
DOWNEY, (Los Angeles County) CALIF.
40 Walker Street, New York 12, N.Y.
34 North Cicero, Chicago 4, Illinois

- includes data in the following:
- Life vs. temperature (showing life as a function of the resistor in hours at a function of its ambient temperature, between -60°C and 150°C)
 - Life vs. load (loads of dissipation showing life as a function of load at four different ambient temperatures, from minus 40°C to plus 150°C)
 - Life vs. humidity (loads) at three series showing life as a function of humidity at three different temperatures, from -40°C to 150°C)
 - Life vs. vibration (life as a function of vibration amplitude)
 - Life vs. shock (24,000 55,000 ft.)
 - Resistance vs. frequency (showing rate of resistance to increased resistance as a function of frequency of exposure)
 - Resistance vs. load (loads of seven series showing rate of resistance to current) resistance as a function of rated working voltage for seven different temperatures, from minus 60°C to plus 150°C)

The performance and resistance data can each be recorded on a single punch card.

► **The Job Ahead.** A senior handle for ECIC is putting together the vast amount of data which is needed before components can be registered in ECIC's

FILTER CENTER

► **MH Damper.** For F-102-Messerschmitt is Honeywell has contracted with General to supply the pitch and yaw damper systems for the new General F-102, not for their F2F (Spartan) reported in this column on April 13. Honeywell's report that the General F2F damper parts recently sent out for build easily assemble the F-102 damper parts. This could give MH an edge over competitors.

► **Step Toward Automation.** Teleplex Corp., Berkeley, Calif., has built a working model of a drill press which takes its operating instructions from IBM punch cards. The card operates two servo systems which position a movable bed on which the work rate. Teleplexing makes data reduction equipment which "reads out" on punch cards or tape.

► **New Thermal Design Manual.** Air-mass equipment engineers faced with heat dissipation problems will be interested in a new manual prepared by the General Atmospheric Lab under Navy BuShips contract. Entitled "A Manual of Standard Temperature Measuring Techniques for Miniatured Electronic Equipment," this is classified "unclassified" and may be obtained from

Shen. Recognizing the burden this places on the component manufacturers, WADC hopes to encourage equipment manufacturers, who must test components for their own purposes to submit their data to ECIC.

Equipment manufacturers who would like to cooperate on component testing can obtain copies of the ECIC work sheets from the General Engineering Section of the Electronic Component Laboratory, WGBL, Wright Air Development Center Dayton Ohio.

WADC's Electronic Component Lab is moving slowly in setting up ECIC. Now that Battelle has outlined the data requirements and test procedures for dual systems, WADC is planning to set up a pilot-run ECIC for dual systems. If the testing equipment industry could set up ECIC, its scope of operations will undoubtedly be expanded to include other types of components.

Unless every available component is registered, ECIC will lose one of its biggest selling points as a single source for all component information. But since ECIC gains industry acceptance, component manufacturers will find they cannot afford not to register their products with ECIC.

Bureau of Ships, Navy Dept., Code 518C, Washington, D.C., according to a CAL spokesman.

► **Boost For High-Temp Transistors.** A new defect process for making high purity silicon is available quantity should speed the advent of higher temperature and higher power transistors and other silicon devices in use to improve the performance of transistors, do defect says. Present price tag on defect silicon is about \$400 per lb., but the cost of the silicon used in a transistor is less than five cents, the company says.

► **New Rugged Sub-Min Tubes.** General Electric's tube department has announced the addition of two new sub-miniature vacuum-type tubes to its line of high reliability vacuum tubes. One is the GL-6113, a condenser, twin triode designed for general purpose amplifier applications, such action has its individual and electronic independent outside. The GL-6112 is a high-beta triode suitable for audio frequency voltage amplifier or phase inverter applications. GE says the GL-6112 has a low noise output.

► **National Electronics Conference.** Approximately 180 technical papers are scheduled to be given at the ninth annual National Electronics Conference, Sept. 28-30, at the Hotel Sherman in Chicago.

EQUIPMENT

TCA Gets Set for New Planes, Engines

► **Carrier's expansion to add 26 aircraft by '55.**

► **Vic-motors, Super Connies, Freighters in new fleet.**

By George L. Chisholm



THIRD-BRANCH FREIGHTERS lead off Trans-Canada's expansion program.



EIGHT 1946 SUPER CONNIES with Turbo-Compound engines will fly long routes.



FIFTY-ONE VICTORINITS will give TCA industry transport lead in North America.

Montreal-Between now and 1955 Trans-Canada Air Lines will take delivery of three new and different types of airplanes including three new and different types of powerplants.

The total number of aircraft will be 26. In order of delivery, they are three Bristol Freighters, eight Lockheed 1946 Super Constellations, and 15 Victor Victors. None of these aircraft is a replacement; they will be added to TCA's present fleet of 23 North Stars and 26 DC-3s.

► **It's All New.** With this fleet of new aircraft TCA will have on a line of new equipment. First, of course, are the three new types of powerplants.

► **British Engines.** A radial three valve engine for the freighter.

► **Wright K1350 Turbo-Compound.** which will drive the Super Constellation engines are placed with the thought that other carriers' Super Constellation DC-3s will be making up commercial operations with the Turbo-Compound as have Trans-Canada says it.

► **DeHavilland Dart turboprop.** a completely new commercial type for the Constellation, will power the Victors.

With the new planes will come many new accessories—fuel research cabin special changes and supercharger controls, fuel-air fuel injection pumps, fuel pumps and moment automatic landing units, to mention but a few.

To run the level the expanded fleet will mean TCA plans to split surface overhaul Super Constellation and North Stars will be based at Dorval near Montreal, and Victors and DC-3s will be overhauled at Steeles Field, Windsor.

► **By Jump.** The large expansion of TCA's fleet reflects the airline's no random growth since the end of World War II.

In 1946, Trans-Canada carried 100,000 passengers, flew 100,000 commercial kilometers and 1,200,000 mail tons. In 1952, the figures were over 1,100,000 passengers, 1,500,000 commercial kilometers, about 5,000,000 mail tons.

Available, ten million of transportation grew from 20 million in 1946 to 173 million in 1952.

► **Why the Victors?** Trans-Canada's management did a lot of hard thinking before deciding what type of aircraft would be suitable to purchase for its aircraft fleet. Although the Constellation had

lots of appeal at the time of the Victor, TCA officials had seen.

Two important reasons for selecting the Victor, TCA officials told Aviation Week, were that it has high passenger acceptability and that wanted to start learning something about jet engines.

What JACK & HEINTZ is doing about...



J&H announces new 1500 va unit with improved regulator for closer voltage and frequency control—adaptable to J&H inverters now in field.

Jack & Heintz's new F137 Inverter (Motor-Generator) is the first in its voltage rating to complete Air Force altitude cycling tests for 50,000-foot operation and has now been released for production by the Air Materiel Command.

Featuring an improved speed and voltage control, the F137, a 115-volt, 600-cycle, single-phase rotary inverter, delivers 1500 va output at 50,000 feet and at -20°C ambient temperature.

Improved electrical insulation, redesigned commutator and brush arrangements, new housing configuration for better air flow, and the new PRS speed and voltage regulator assembly represent major advances in high altitude inverter performance.

J&H looks to the Future

The F147, capable of 2500 va at 50,000 feet, at -20°C ambient temperature, has completed cycling tests at Jack & Heintz laboratories. We are also processing the design of an environmental-free 2500 va inverter for still higher altitudes and ambient temperatures, in accordance with an Air Force development contract.

Our engineers will be glad to work with you in developing inverters or other Rotomotive equipment to meet your specialized needs. Write Jack & Heintz, Inc., Cleveland 1, Ohio.

JACK & HEINTZ

CLEVELAND 1, OHIO

Sold Office New York City • Washington, D. C.
Boston • Dallas • Los Angeles • Seattle

HIGH ALTITUDE INVERTERS

J & H 50,000-FOOT F137 INVERTER APPROVED FOR PRODUCTION



★ REDESIGNED
COMMUTATOR
AND BRUSH
ARRANGEMENTS

★ IMPROVED
ELECTRICAL
INSULATION

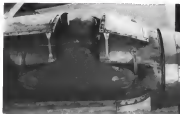
★ NEW HOUSING
CONFIGURATION
FOR BETTER AIR FLOW

NEW PRS SPEED AND VOLTAGE REGULATOR FOR F137 INVERTER PROVIDES INSTANTANEOUS OPERATION WITH NO WARM-UP PERIOD, VOLTAGE REGULATION CLOSER THAN PLUS OR MINUS 1% AND FREQUENCY REGULATION CLOSER THAN PLUS OR MINUS 2.5%



Rotomotive  **EQUIPMENT**

Aircraft Generating Equipment—a-c and d-c—including Control Systems and Components • Electric Starters • Actuators and Special Aircraft Motors • Custom-built Commercial Motors • J&H Rotomotive Magnets



INSIDE VIEW shows how exhaust gases are cooled near the TCA's North Star.

The American industrial design firm of Butler Zimmerman was hired to lay out the interior of the cabin, because, as the owner's words, TCA "demands the U. S. industrial engineering approach to give clean, functional interiors to its aircraft through each device to control debris of aircraft, clean lines and harmonious color schemes, etc." Butler Zimmerman had done previous work on the Glavin B. Martin series—the 10-2, 5-0-5, 4-0-4.

So a Canadian airline buys British aircraft whose interiors are designed by an American firm.

■ **About the Viewmont**—Here are a few comments TCA engineers had to make about the Viewmont.

■ **Propeller blades**—Cold weather tests last winter revealed the effectiveness of the engine's propellers at sea-level altitudes. The Royal prop blades do not go into reverse pitch until they go to about the pitch, actually to 2 deg. positive. Because the viewmont pitch rate is long starting longer to low

as possible and to allow engine to run at high idle again. TCA engineers say that the flat pitch of the propeller was an effective on the average Canadian water routes that better were handled over land. Using landing, stopping was almost too violent.

■ **Wheel brakes**—The Viewmonts use Dunlop multiple-disk brakes equipped with the Macdonald anti-locking unit which is a hydraulically controlled anti-lock device. Craft is also equipped with a pneumatic, non-differential brake line.

■ **Cabin improvements**—TCA says the engine manufacturer (Rolls-Royce) preferred that the horsepower required to generate the Viewmont's cabin be reduced from the engine as a means of saving weight. Goldner blames other than bleed air from engine compressor. Also there was the possibility that an would look into the compressor action and bleed into the cabin when supercharger controls will be furnished by A.R. Harris.

■ **Power control**—The Royal engine power and propeller rpm synchronism flow control is a new slide process unit on TCA engines. It has three main slide engines (Nos. 2, 3 and 4) to the master engine (No. 1). The control is so exact that slide engines immediately alter within 1/10 of an rpm at the master engine. Acting slowly and smoothly. To do this the most exact manual control of propeller pitch with control of fuel flow to the engine.

■ **Anti-icing windshields**—The three forward cockpit windows provide the Viewmonts will be of electrically heated. Now glass as on the Super Constellation.

■ **North Star**—From Canada's people are pleased with their North Star or as some of them call the plane—'Mac'. In general TCA is well 98 or better on it.

The 17 domestic aircraft turned in a daily schedule of 124 in a day since May 1. This takes into consideration four aircraft as well as one on overhaul and two spares. If active aircraft only are considered, utilization figure drops to 16.2 in a day.

DC-3 utilization stands at 10.3 in a day.

TCA has modified its 17 domestic North Stars to accommodate 48 in instead of the original 40 passengers.

TCA admits the North Star is a bit of a 'half breed aircraft' as far as the routes it is operated in. It is considered a hybrid airplane put in this way. The plane is a little too much aircraft for international use and not quite enough for international.

On domestic runs, the plane can carry 48 passengers. Average domestic North Stars take off some 4,000 lb. under the maximum gross weight of 80,000 lb.

■ **Merlin-Rolls-Royce**—Merlin engines which power the North Star have both fuel pump and fuel pumps the engine area.

On the cold side, the engines are easily interchangeable from one to the other. That plan the fact that all accessories are behind in a fixed position, gear box, mounted remotely from the engine and driven by a single universal-jointed shaft, means that TCA can change all four engines in 30 hours and no wonder for the records set according to Jim Burt, TCA's director of maintenance and engineering.

It is not unusual for the company to pull an engine, but has developed a mechanical adjustment system that goes through the line concerning procedure of changing plugs, trouble-shooting sparkplugs (which being steps or plugging combustion, etc).

When TCA has finished testing systems on the Merlin in the days, five years, this adjustment system will no longer be usable. With constant, the engine is no longer completely interchangeable. The two right way to

changing, and the two left, but right cannot go on lefts and vice versa.

■ **Merlin's Merlin**—The high noise level and low cylinder-bore time of the Merlins are debatable. Passengers have been objected to the blast the engine creates in the cabin. So TCA set out to modify the Merlin. A crossover exhaust system was developed by the engine's engineers and put into production by Canadian (Aviation Week May 12, 1952, p. 72).

With the crossover, exhaust gases from inside through the fuselage are dumped into a collector. From the collector they are ducted over the top of the engine on one line, and suction line to a plenum chamber where in-board and outboard gases join. They are dumped outboard through three large round exhaust ducts, called by the airlines as the front to help cooling and to ensure exhaust out of the cabin.

Common exhaust tubes raise level in the mid-range by about 6-5 inches. And they provide no sacrifice in engine performance, according to TCA engineers. Moreover, the additional weight of the crossover was more than compensated for by replacing cooling liquid mixture with aluminum with a modification exhaust ducts, alone, only with the crossover design.

■ **Longer Life—Current**—Merlin over-haul period is 1,000 hr. But cylinder blocks are changed every 500 hr. However, TCA is on far verge of entering the engine's overhaul period to 1,200 hr. and the cylinder block's to 900 hr.

Factor behind this extension is an exhaust valve change which conducts heat from from better than in the old installation. But before that block life was gradually be extended to 900, 1,000 hr., in which case the whole engine will be changed in a unit instead of changing blocks only.

New Plug System—TCA has a new spark plug system. The company recently indicated the practice of using new plugs only—the Lodge LK-88 platinum electrode and. Flaps operate the life of the platinum block. It is used as accepted. The platinum electrodes are salvaged. When cylinder block time is extended to 600 hr. plus, life will move up the corresponding 100 hr.

TCA engineers are very pleased with their "new plug only" system. They say that "spark plug irregularities have almost vanished" and it is cheaper to keep used plugs and install new ones than it is to operate a spooling overhaul facility. — we have experienced so much further, engine repairs on engine failures attributable to spark plugs in the three months." TCA has been using new plugs only for the past four months.

Plugs had been pulled every 100 hr. and reconditioned and or more times de-

HOT

UNDER THE COLLAR...

But This
Special Purpose Clamp
WON'T BLOW its TOP!

A jet engine exhaust is a volcano of heat, pressure and vibration. The clamp that goes around it must withstand these conditions—and hold tight.

Breeze makes a clamp for this exacting use, and for a wide variety of other applications where stock items just won't do.

Just as Breeze AERO-SEAL hose clamps have set higher quality standards in their class, so Breeze stainless-steel or copper clamps have the same strength and other properties for every special use. Any design, any material, any quantity. Tell us your clamping problems.

OTHER BREEZE PRODUCTS

Flexible Metal Tubing and Couplings,
Aircraft Airconditioning Systems,
Special Drives and Gear Boxes,
Special Electrical Connectors,
Metal Bellows, Jet Engine Insulation.

MAKES
AERO-
SEAL
PRODUCT

BREEZE

CORPORATIONS, INC.

41 South 11th Street, Newark 7, N. J.



OUTBOARD DETAIL shows plenum chamber and three large ports for gas exhaust

keeping an altitude. The change in the new system coincides with block change, resulting in a significant number saving.

• **Super Superchargers**—TCA's estimate of the English Goddard valve system changes used on its North Star is that the blowers are "superb."

The airline, now well into its third year of operating the nacelles, says they operate for the low figure of 31 cents per hour, according to Blue.

Then in how TCA serves at the 31-cent figure, Goddard blowers' original cost was \$1,263 per unit. Afterward over a seven-year period, this results in a depreciation cost of approximately 10 cents per hour flying time. Low service overhead cost for first three years of operation averaged 8 cents per hour and flying hour and replacement of damaged components cost an average of 31 cents for the same period. Total costs rose to 21 cents per flying hour. Mechanical expenditures due to internal failures within the superchargers have been negligible.

In the past few months, the only failure has been the check section of the blower drive shaft. Two other features of the Goddard superchargers that TCA likes:

- They are cheap. The latest estimates that in 1952 it cost over \$500,000 in operating and overhaul costs by using the Goddard unit instead of the Douglas-designed superchargers, such as it is fitted in DC-6s and 74s.
- They are light. The TCA Goddard superchargers and gearboxes system weigh 151 lb. per plane less than the Douglas system, according to the company's engineers. Half of the weight saving is attributable to the superchargers themselves, others half to the system.

TCA's Clayton Glass designed the new four-cooled mechanisms for the North Star's pressurization system. The aircraft's engineers say that, in the best of their knowledge, it is the first such system ever installed into a commercial aircraft whose basic cost is electrical.

• **Chlorinated Water System**—The air has an interesting new approach to the water system called its Super Constellation and Viscount. The planes will have a chlorinated water system which will serve both for drinking and washing. Chlorine is filtered out before being consumed.

TCA cites three advantages for its chlorinated system:

- Eliminates heavy, fragile vacuum bottles, several of which are normally carried to supply passengers and crew with drinking water.
- Chlorine helps keep water system clean and free of rust, by killing bacteria.
- System weighs 15 lb. installed, less than the vacuum bottles it displaced. The chemical cartridges, used to filter out the chlorine, cost \$1.35 a piece to

replace and replacement is at once as twice as new. There are three cartridges in the system.

- How it Works—Chlorine is introduced into the water either in capsule form or is injected into the water and need to supply the plane. For instance, on 3012 parts of chlorine to 1,000,000 parts of water. First to consumption, it is filtered out through charcoal filters produced by Eveready Water Co., Chicago.

There are five outlets in each Super Constellation, one in the galley and two in each of the men's and women's lavatories. Since there is no pump to water in these planes, a supercharger 18-gal. tank is being installed next to the main tank.

- **Phobic Blue**—Polyethylene plastic hose is effective for sucking water through the aircraft, correct officials say. It is light, it is sufficiently expandable so that water can force its way without rupturing the walls, and it is relatively cheap.

Installation is easy because flexibility makes it simple to bend around the cockpit and ducts, and it may be used with standard fire fittings at ports. It is noncorrosive and will last about indefinitely. TCA has had it installed for over two years on its North Star, which airplane is as solid a domestic in most commercial aircraft ever flown, without experiencing any trouble with the water system.

- **Annual the Super-A** line of the airline's facilities at Montreal and Winnipeg brought out some outstanding items.

- TCA is planning 7th-order attention as a starter for the Viscounts first of the turboprop version will be delivered in the fall of 1954, so first engines will come due for overhaul by May of 1955. TCA will overhaul its own Deets and is now starting construction of a test house for that engine. Actually, the new engine overhaul facility will be a one-stage after burning overhaul facilities for reprocessing engines, turboprops and propellers.

The airline expects the Deets' overhaul period to be up to 700 hr by the time its own come in for first overhaul, it is sending men to the United Kingdom to take formalization courses on the engine, airframe and certain accessories.

TCA plans not only to take over the overhaul of the Deets when the time comes, it also plans to continue overhauling the DC-6's R3590s and North Star's Medius Turbo-Compound R3790s on the Super Constellation.

For the time being, TCA may take them into its own shops too and turn out the R3590s.

- The line's engineers like the English Lucas gasless aircraft faster. They say "It incorporates all the best ideas

of gas turbine design. There is very little difference between the Lucas heater and one out of a jet engine." Fuel flow is modulated so overall results in an automatically controlled, constant temperature air output independent of altitude, ambient temperature and other variables. TCA prefers this to the system as widely used in the U.S. of constantly cooling the heater by passing air over it and off. Another good point in the two-stage Lucas gas turbine system along the back timing principle.

- Heater output is 250,000 Btu, and "adequate heating is superimposed to TCA, flying in the weather we do," the company says.

- The carrier will test the Scintilla automatic, high-energy heater ignition system at once as it becomes available. An equivalent British system, made by Rover and named a Lodge plug, will also be tested. TCA has the British system, but has not yet installed it.

- **Emergency lighting** chosen by TCA is the Venner emergency lights which with better features is a reference to which defines the light rays. The unit costs less than 560 and weighs less than one pound. The light's power source is a silver cell battery. It will be installed on all Viscounts and TCA is considering installation on its entire fleet of aircraft. Engineers have not yet decided whether to charge lights on the emergency exits or place them over the exits.

- **Headlights**—airborne lighting overhead will be installed on TCA's fleet of Super Constellations.

All the North Star and DC-6s are used for the Scintilla ignition unit as one means has given trouble. It will indicate just the oil and not the supercharged ambient timer. But TCA has high price for the analyzer. Engineers say that since they started using overhead, coupled with the cost of the "oil when not" check, the all delay due to ignition system malfunctions have plummeted 60%.

- TCA uses both three- and four-bladed propellers on its North Star. In the main, three-bladed props are used on trans-Atlantic flights because of slightly better cruise performance. Four-bladed units are used on domestic aircraft because of slightly superior takeoff and climb performance.

- TCA's Super Constellations will have seats for 54 coach passengers and only 9 first-class passengers. "This means that we can treat the latter like little gobs," say TCA spokesmen.

- **Radio equipment** selected to Seaboard and Western's will be put on TCA's Super Constellation. TCA believes this to be one of the first examples of two airlines (and of different nationalities) agreeing on common equipment for their aircraft.



Four-Engine Super Constellation. Seats 6. Powered by four 240-hp Lycoming aircraft, ground engines.

Lockheed Super Constellation. Amphibious flying, office, sleeping, dining, air-conditioned, ground engines by Lycoming.

Safest "offices" over earth

You are now looking at the "safest" carrying America into a great new era of safe commercial aviation transportation. Each of these twin-engine, multi-passenger planes is powered by Lycoming—bring a leader in the aircraft engine field. Each has the double dependency of our

advanced Lycoming engines—in power but that the planes can only fly the safe Lycoming full-time carrying machine. To be sure, you may place it there are other "offices" over earth—the standard aircraft in service around the world. But for double safety, write us at your local

SEE LYCOMING AND LYCOMING SERVICE IN

SEE LYCOMING

Lycoming Engine Division, Lycoming, Pa. (AEE) Lycoming Engine Division, Inc.

40-Model Super for 400-hp and 400-hp. Lycoming and Lycoming Engine Division, Inc. (AEE) Lycoming Engine Division, Inc.



Four-Engine Super. Seats 6. Dependently powered by four 240-hp air-cooled Lycoming engines.

Lockheed Super Constellation. 40-hp engine plus power by 400-TBO-hp air-cooled Lycoming engines.

SPRACO



SPRACO PRODUCTS

FUEL INJECTION NOZZLES

SPECIALISTS IN DESIGN AND PRODUCTION

SPRAY ENGINEERING COMPANY

ENGINEERS AND MANUFACTURERS
109 CENTRAL STREET - SOMERVILLE 49, MASS.



*Easy maintenance,
speed repairs
with DOT
wire harness bands*

Wires can be added or replaced one-handed, without removing the bands. Spring tension prevents accidental opening. Resilient, moisture-proof, strong stainless wire, cushions them against chafing. Using will not pull loose. Illustration shows band with swirl-type anchoring clip. Other types available for mounting with rivets, snap-fitter or snap-on clip. Made in 7 standard sizes from 3/4" to 2" diameter.



MONADNOCK MILLS For leaders in machinery of UNITED-CASE PATTERNS CORP.

Monadnock, with a wealth of factory experience, welcome inquiries from manufacturers who wish reliable development and production facilities.

test that the aircraft's attitude-tipped laterality down about 30 degrees to the right and also tipped down 45-degree somewhat at low altitude in leveling the ends.

INVESTIGATION—PART I HYDRAULICS

Nos. 3 and 4 engines were disconnected. This would require less two can drive gear boxes for each of the front and rear gear cases. Each gear consists of a drive, intermediate and pilot gear. Teeth of the intermediate gears of both front gear cases of both of three engines had failed, causing immediate and full power loss. Other gears in these three boxes suffered damage to a lesser degree. These engines had, as mentioned a total time on air of 52-1/2 hours and 18-1/2 hours, respectively. The latest report to have been due to the design, the manufacturing and the operation of these gears. The specific cause of the tooth leakage was the faulty configuration and/or the surface finish of root side of the teeth.

There had been similar failure, previously in other engines of this model. As a result, the engine manufacturers had started, prior to this incident, a modification program to incorporate a low pinion case drive for the original two-pin case drive. Its purpose is to distribute the load and thus lower the stress on individual gears.

Conversely, the engine manufacturers had a low pinion program aimed at eliminating or minimizing the subject type of gear failure as follows:

1. Containing the change to a four-gear case drive.
2. Increasing the backlash limit on all gears in the case drive from .006 in. to .010 in. to .015 in. and also reducing the height of the teeth of the small case drive pinion further to insure against tooth interference at loading conditions.
3. Interpositioning to 90-to-45-deg chamfer on both ends of the teeth of the case drive gear to improve the load distribution in the case drive gear teeth.
4. Strengthening the gear of the valve train in such a position within the piston forcing limits of the parts. This part of the program is the most complicated and will require at least six months before parts are available.

Operation using the subject model engine are actually making continuous inspection checks of all engine valve components and before (one gear or parts of tooth) are to be found. The highest was similar in nature to some 45 other instances of failure of the case drive gear in the same model engine as presented in operation by two U. S. carriers and one by the aircraft manufacturer during test.

A study and analysis of the Test Report, Report of the subject engine, Wright Anemometer Device 975 CH101, revealed that a failure of the case gear had occurred during the CAA observed 150-hour

*These gears are about 6 1/2 in. in diameter, about 1 1/2 in. thick and have a 10-tooth gear of small tooth. An earlier design had fewer teeth (10 teeth). The change was made to allow more teeth on the gears and reduce overlapping of teeth (10-tooth).

type configuration test along with several other failures of major components of a nature that would render engine operation unreliable. In all cases of the reported gear case failure the manufacturers furnished an explanation as to the cause and selected corrective action which were being taken. "Nevertheless, the same failure which occurred during the type certification test, including failure of the crankcase, the valve springing action, the clutch support bearing, the exhaust valve spring and the cam ring gear, the engine received its approval without any further test in order to be CAA 14.11 (b) (1), (2), (3), (4), (5) which was effective of the time. "Section CAA 14.11 (b) (1) and (2) and (3).

If any part shows evidence of fatigue or impending failure in actual operation, the engine will not be considered satisfactory unless appropriate corrective measures are taken and proven satisfactory by suitable testing procedures, that the Administrator may accept other methods of testing procedures.

The CAA continued the engine, without further testing to prove the superior maintenance, by accepting what is considered superior proof in the form of a written report indicating that it is correct when the drive test model engine.

INVESTIGATION—PART II HYDRAULIC SYSTEM AND CREW TRAINING

It may be pertinent here to explain some of the facts concerning the hydraulic system of the Lockheed Model 1049. Each of the four engines has a hydraulic pump. These are Nos. 1 and 2 engines which pump oil individually, in the event of failure of either Nos. 1 or 2 engines hydraulic pressure is supplied from the aircraft's right controls and for control other purposes. This is known as the primary hydraulic system.

Pumps on Nos. 3 and 4 engines furnish power for individually, in the event of failure of either Nos. 3 or 4 engines hydraulic pressure is supplied from the aircraft's left controls and for control other purposes. This is known as the secondary hydraulic system. If an engine fails the primary hydraulic system but the reverse is not possible.

If Nos. 3 and 4 engines are inoperative there is no means of obtaining rear wheel steering, wing flap, motor, landing gear extension or retraction, and various other systems. This is known as the emergency hydraulic system. If an engine fails the primary hydraulic system but the reverse is not possible. If Nos. 3 and 4 engines are inoperative there is no means of obtaining rear wheel steering, wing flap, motor, landing gear extension or retraction, and various other systems. This is known as the emergency hydraulic system. If an engine fails the primary hydraulic system but the reverse is not possible.

Lockheed's Airplane Operating Manual for the 1049 series, which has CAA approval and was issued the same time as the following release in emergency use of landing.

THREE MORE GOOD REASONS FOR CHOOSING THE PLANE WITH CONTINENTAL POWER





MODEL G-470-A



MODEL G-470-B



MODEL G-315-A

THEY'RE YOURS FOR GREATER UTILITY, THESE THREE GREAT NEW CONTINENTALS

Here's What They Provide:

1. **DEPENDABILITY** reflecting more than 50 years' engine-building experience.
2. **SIMPLICITY** for maximum ease of installation, adjustment and repair.
3. **COMPACTNESS** adapting them to modern air-frame design.

...and like every Continental, they're backed by established parts and service facilities all over the world.

For bar barities with full specifications, performance curves and installation diagrams, address:

Continental Motors Corporation
Aircraft Engine Division
MUSKOGEE, MICHIGAN



NEW IDEAS IN MEASUREMENT

Can they help you improve your products?

FACTS ON STRESS, strain, vibration and other characteristics can help you improve the design and performance of your products. Brush Instruments help you get design and operating data easily and quickly. The applications of these instruments, and many new ideas that may help solve your particular measurement problems, are presented in this new booklet "Instruments for Modern Measurements". Send for your free copy today.

BRUSH ELECTRONICS

INDUSTRIAL AND RESEARCH INSTRUMENTS
HIGH ELECTRIC RESISTANCE • ACUSTIC DEVICES
RADIANT RECORDING EQUIPMENT
ULTRASONIC DESIGN LAM



COMPANY

*Formed by
The Brush Development Co.
Brush Electronics Division
(a subsidiary of
Brush Engineering Co.)*

CONTENTS

Electronic Measurements
Physical Measurements
Surface Measurements
Acoustics/Windage
Measurements
Stress/Energy Applications
High-Speed Measurements
Transducers

BRUSH ENGINEERING COMPANY, 4001 46th
2401 Parkton Avenue, Cleveland 10, Ohio

Please send free copy of "Instruments for
Modern Measurements"

Name _____
Company _____
Title _____
Address _____
City _____ State _____

E-BRACKS, EMERGENCY OPERA- TION . . .

- (1) The brakes may be applied on the following ways:
(a) On secondary hydraulic system, brake selector in NORMAL.
(b) On secondary hydraulic system, brake selector in EMER.
(c) With secondary hydraulic system inoperative, brake selector in EMER, system supplied by accumulation.

The accumulation, mentioned above, were used by the crew to be fully charged (1,000-1,500 pounds per square inch) prior to landing. It was also found that there was considerable shock when checked a few days after the accident.

The proper landing procedure, therefore, as stated under (1) (c) above, was to keep closed the brake selector in "Emergency." This was not done, the captain attempting to obtain landing pressure from the head pump rather than from his fully charged and instantly available accumulation. These accumulations were enough for 10 full applications of brakes if the system in face of it, in position, with the system not completely bled, there are at least no brake applications available.

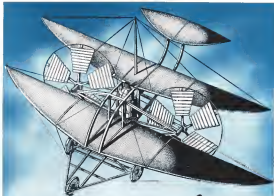
Before landing at Fallow the crew went through the company's cockpit check list for normal operation. It did not have emergency landing procedures specified although the manufacturer's SOP check list on the airplane's table included abbreviated emergency landing procedures. In the subject cockpit record, the flight engineer's duties in several feet aft of the two pilot seats and at right angles to them. Thus the flight engineer could readily see either the accumulation pressure gauge or the brake selector valve. The positioning of the brake selector valve is presently a subject function. On this model aircraft the flight engineer has no specific duties in connection with use of the emergency landing system—during an emergency he acts upon the captain's order. Presumably, the flight engineer would have had no reason to believe, or way of knowing, that the emergency landing system was not being utilized properly.

On board the aircraft was TWA's Operating Manual for Cabin Crews, but it applied primarily to the two cabin models. At the time of this accident TWA's Operating Manual for the Model 740 did not contain instructions relative to correct landing under the subject condition. TWA was in the process of having the manual up to date for the Model 740. However, there was a Lockheed operating manual and check list for the Model 1649 around the aircraft. They contained explicit emergency landing procedures that if followed would have yielded normal landing.

ANALYSIS—PART I POWER PLANTS

Obtain the pertinent portions of the CAR applicable to the subject engine from the Administrator will authorize to judge whether or not density runs and replace most of your duties. The indicated facts should be required. It appears that the Administrator's judgment in the case of the

"This check list was in a card and was not available." Model 740-1000 Check List and the other not furnished. (Model 740-1000-1000 Emergency Procedures).



... out of this came Aviation

... a precision industry

To serve this great industry a manufacturer must maintain the best and most modern equipment available, operate it with skilled craftsmen, and use every existing method of tightening specifications and cutting production costs. Indiana Gear is such a manufacturer—a company of craftsmen producing fine quality transmissions and axles for industry.



This is the Model gear room in I. G. W.'s new modern heat treating department—one of the contributing factors to Indiana Gear's above ability to create hardy, durable parts to existing specifications.



INDIANA GEAR

INDIANA GEAR WORKS, INC. • INDIANAPOLIS 7, INDIANA



Greer Hydraulic Accumulator Test Stand, shown here at Lockheed's Greengate plant, provides a drop time suitable to fully check the performance of hydraulic shock absorbers including system pump at flow rates to 200 gpm, pressures to 2400 psi.

Why Does Lockheed Aircraft Test with Greer Equipment?

Why does almost any aircraft builder you can name test with Greer?

Because the entire industry knows it can depend on Greer. It's as simple as that. That's why Lockheed Aircraft Company, famous builder of the Constellation and many military aircraft, chooses Greer Test Equipment. Greer stands in an unqualified record for service in the aircraft industry. A reputation that guarantees complete satisfaction. A lot of customers that reads like a "Who's Who" of aviation. Planners in test equipment, Greer has more recently entered industry-wide service by furnishing the standardization of test equipment. A study of the Greer catalog (write us your

letterhead for free copy) will reveal a remarkable selection of standard units for a great variety of test jobs. For out-of-the-ordinary requirements, call or write Greer's engineering department. Men with experience you could never match are waiting to go to work on your problem.



Greer Dual Fuel Booster Pump Test Bench, shown on left, provides two components for checking 14-18 and 1000-psi performance on two fuel pumps simultaneously with flow up to 50,000 gph and pressures to 1000 psi. Greer Fuel Pump and Accumulator Test Stand, on right, checks all fuel components with flow to 200 gpm and pressures to 2400 psi.

Greer Hydraulics Inc., 454 Eighteenth Street, Brooklyn 15, New York
Field Office: 1949 Van Cleave Road, Chicago, Illinois • 18 South Main Street, New York 10111 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities

subject engine was questionable and did not lead to appreciably conservative values since the performance was based on the fact that parts obtained in the initial group had not exhibited the excessive tests when it failed and tested on other engines but of a different model.

As a matter of fact, engineering opinion is that both conditions of operation of different type engines, including what appears to be some design changes and/or tolerances, may have an influence on the reliability of individual components of the engine. A review of the engine history of the subject model engine definitely indicates that the conservative nature of the test was not caused by the manufacturer subsequent to the type test was wholly inadequate.

ANALYSIS—PART II HYDRAULIC SYSTEM AND CREW TRAINING

The aircraft's secondary hydraulic system complexity, but do some of it early with the testing of Nos. 3 and 4 propellers. However, this was not sufficient of that hydraulic system is only one was there and functioning of one component of that hydraulic system including the maximum for emergency braking. The sample test of the crew is that the emergency landing procedure was not met.

The captain attempted to land on the beach but due to it and would have been proper and successful with previous tests. Lockheed (Models 104 and 105) as which he was highly experienced. The experience on Lockheed Constellation was the Model 104, 15,150 lbs., on Model 105, 110,150 lbs. and on Model 104, 104,150 lbs. The training for the Model 104 included four days of ground training and four hours of flight. The flight training included a landing and taking off with Nos. 3 and 4 propellers functioning and successfully with the secondary hydraulic system operating, including adequate landing procedure without use of the accumulators.

The cause of the emergency landing system was not used on test only in the fact that the company's training program for Model 104 was centered in that it did not emphasize sufficiently the difference in the operation of emergency landing. This is evidenced by the captain's statement that he tried to land the aircraft with the brake release in the "normal" position where it should have been in the "emergency" position. He demonstrated his uncertainty with the hydraulic system as that he attempted to do the emergency landing with the brake down and not, and only then, did he realize that he had no hydraulic pressure on his brakes.

The captain's uncertainty with the hydraulic system of the 104 is further borne out by his statement that immediately after touchdown he was attempting to stop the aircraft with the nose wheel. The risk involved almost a loss of secondary hydraulic pressure.

Since the first officer and the flight instructor had previously the same sort of experience on the three Constellation aircraft, the captain, who is a trained test pilot, section and separate engine as far as emergency landing in emergency conditions on the subject Model 104. That the captain had been to other tests, including the emergency landing of a different model aircraft, was not a factor in the test.

recs. in line of case which stopped. Since the company's own operating manual for the 104 is not complete and did not include emergency landing procedure, the company should have specifically instructed crew to use the backboard operator manual and check list, about the aircraft, which did contain the correct procedure. Had these latter been followed, the accident would probably have been avoided.

Although the company may be relieved by the fact that the emergency landing procedure was not followed, the accident was not caused by the crew but by the company's failure to provide the crew with the correct procedure, as stated in the report on the accident.

Of course the circumstances of this accident were extremely unusual. It was at night, on an airport with which the crew was not familiar and with two engines on the same side of the aircraft. The crew was not adequately trained in emergency landing procedure. But the accident on the report is that it was a Captain's error.

Based on the above, to command both operations for the most efficient manner as when they occurred on the other emergency procedure.

FINDINGS

On the basis of all available evidence the Board finds that:

1. All required emergency landing procedure, the aircraft and the crew were not trained and not.
2. The CAA representative on the subject model engine following emergency landing of a crew that had not been the initial test run.
3. Complete loss of power from Nos. 3 and 4 engines forced a landing to be made at the Fulton Street Auxiliary Air Station, New York.
4. The proper landing procedure was not met.
5. The crew's training program for the aircraft on the subject model engine was not adequate.
6. The aircraft's emergency landing procedure and its manner of emergency were questionable.

PROBABLE CAUSE

The Board determined that the probable cause of the accident was improper use of the emergency landing system during the course of an emergency landing. This landing was attempted by complete loss of power from the Nos. 3 and 4 engines due to the failure of their drive shafts.

A contributing factor was inadequacy of the company's Lockheed 104 training program from the former model aircraft concerning the difference in emergency procedure.

By the Civil Aviation Board

- At: Donald Ryan
At: Thomas D. Dwyer
At: John Lee
At: Joseph D. Adams
At: Chas. Gentry

USE "Double Feature"

INSULATING TUBING AND SLEEVING

TURBOTUR

Only the most economical insulating tubing and sleeving for commercial use... easily and readily available to the insulation demands of Greer A & B. Superior A & B insulates emergency—space and efficient tested when you use TURBOTUR.

Only the best insulating tubing and sleeving... Meets meeting specifications for durable resistance to high or low temperatures... made of superior materials in good long wear—won't crack, bend, shrink, or peel under rigorous treatment... excellent flexibility... can be bent, bent, folded, or stamped on to any shape in perfect condition... easier to handle because of its flexibility... won't kink... not affected by oils, solvents, alkalies and acid... high dielectric strength and long life.

PROTECT YOUR EQUIPMENT — SAVE MONEY — GET "DOUBLE FEATURE" TURBOTUR

Insulating Material TURBO Brand Specials 5 mm 1920

The William BRAND and Co., Inc.

Dept. AS-7, Wilkes-Barre, Penn., U.S.A. Tel. MA 4411 or 3-1661

TURBOTUR Insulating Tubing and Sleeving • TURBO Insulated Wiring • Wire Insulation • Electrical Taping • Insulated Saturated Sleeving and Taping • Canvas Cloth, Tapes, Papers • More

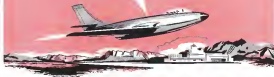
SALES REPRESENTATIVES IN PRINCIPAL CITIES

PRECISION-BUILT BEARINGS SPEED MODERN JET PLANES!



Jet planes fly faster than the speed of sound... roll over at rates of 12,000 RPM... temperatures as high as 500° F... with a minimum of lubricant there are the punishing demands today's modern aircraft put on bearings! So will wonder then that major manufacturers of jet engines consider them as lower stress bearings. Precision-built by Bower, these bearings are made of an alloy, these quality bearings operate with complete efficiency at peak speed and temperature levels. What do you make? If your product demands top-quality bearings you'll be wise to specify dependable Bower bearings.

THE BOWER ROLLER BEARING COMPANY
Detroit 24, Michigan



BOWER

ROLLER BEARINGS



FINANCIAL Giannini Progresses in Avionics

Company's story illustrates problems that research engineers face before they break through to profits.

The recent public sale of additional shares by G. M. Giannini & Co., Inc., sports an interesting account of the birth and development of a leading avionics company.

Tim President, Calif., firm-based on engineering ingenuity and its application—has made a number of major contributions in the avionics field, although it is small in terms of financial resources. Its development challenges the defect: pioneering effort, usually required before research engineers can obtain any measure of success.

► **Low Capitalization**—Despite the recent public sale of 13,316 shares of stock at \$12.00 per share with net proceeds of around \$160,000 to the company, a relatively small capitalization prevails.

There are now 61,373 shares of common outstanding, as well as 2,278 shares of convertible preferred. Each share of preferred is convertible into 12 shares of common. Also outstanding are options on 3,247 shares of common, exercisable at \$1.00 per share. Giving effect to the complete conversion and the exercise of options, there will be 300,000 shares of common outstanding in the sale equity capitalization.

Management, as represented by officers and directors, accepting for conversions and the exercise of options, however, can account for about 52,000 shares of the broadened capitalization. This qualifies the ownership interests to a relatively closely held group.

Colonel M. Giannini, founder and president of the company, retains a total of 25,500 shares or more than one-fourth of the adjusted representation. The financial development of the company is largely the result of his efforts and the ownership interest may well represent a major financing difficulty to maintain and extending over a long period of time.

► **Early Problems**—A review of financial results reveals that there were a number of years when the survival of the enterprise may have been in doubt. For example, as recently as 1949 and 1950, adjusted net losses for the two years were to exceed those \$141,000 on total sales of about \$2 million for the period. With the company's relatively limited resources at the time, this was quite a dilemma.

Expansion was rapid, however

Sales and other income in 1951 amounted more than two and one-half times over 1950 to about \$2.6 million, and left the company with \$263,726 after taxes and profit losses.

For 1952, sales increased sharply again—this time to \$4.7 million—with net income of \$265,728 after taxes and profit losses. About 98% of 1952 sales were for defense work, most of the deliveries being made to great construction for missiles and planes rather than directly to the government.

► **Current Report**—Sales for the 6 to 10 June 21, 1953, are reported at \$2.1 million with net income of \$94,866. Estimates indicate that for the full year, net income may amount to around \$200,000, the balance of excess profits being in a drop.

An interesting sidelight is present in the value of the company being one of the holders of a bank patent on atomic energy known as the Fermi patent for which the U. S. Government recently awarded \$100,000 against outstanding claims. G. M. Giannini & Co. holds a one-eighth interest in the Fermi patent and this has not as yet been reflected in its current accounts.

► **Automatic Control Components**—Giannini is engaged in the development, manufacture and sale of components for automatic controls, used principally in connection with aircraft and guided missiles.

Its products, in the most part, are not designed as the solution of certain technical problems "connected with the increasing velocity and altitude of the flight of aircraft and guided missiles, and the accuracy or advantage of substituting automatic controls for human controls."

These products are represented as instruments for incorporation in components of flight-path-control systems, servo-drive for radar controls, navigation and jet engine, rocket, and other engine controls, and controls of cabin pressure, fuel, and other pressure systems. They are also used in components in systems to identify aircraft and the characteristics of ships from the airborne object to a receiving point, and in flight testing and research.

► **Basic Products**—Basic products include pressure devices, gyroscopes, accelerometers, and stress and temperature gauges. These instruments, when

coupled with other control instruments, are represented as capable of acting, for example, to return the flight vehicle to the predetermined or desired flight path. As such, they are operational in nature.

When coupled to a telemetry system (such as radio), they enable the transmission to a remote point of the variations in the flight characteristics, either for control at that point or for performance data such as in flight testing.

This development program centers on control devices for use in connection with high-speed, jet-powered transports and jet-type aircraft. It is reported as "increasingly self-contained" the control devices must await the development of the primary wing vehicle."

In terms of financial resources, Giannini is a modest sized firm, a modest enterprise. Aggregate physical assets are now valued on the books at around \$3 million. Giving effect to the recent public financing, net worth is now estimated at around \$1,000,000, equivalent to 58.75 a share on the reported capitalization, fully converted.

But the accomplishments of the company in technical development—including the greatest segment of having a bank patent on atomic energy, and not always capable of being reduced to simple balance sheet terms.

—Selig Altschul

ATA Asks Repeal Of Transport Tax

Airlines last month asked Congress to repeal next year the 17% transportation tax passed to cover civilian travel on crowded transports during World War II.

J. D. Dornan, Air Transport Association and national general counsel, told the House Ways and Means Committee the government has collected \$2.2 billion on the transportation tax—75% of it since the end of World War II.

"Thus, he said, 'over three-fourths of the total collections... have gone to direct subsidization to the underlying reason for the tax.'"

Dornan noted that defense revenue since the war has been to exceed income in a military free reserve. "The poultry tax on transportation was enacted for the purpose of achieving a quantitatively opposite result," the ATA official told the legislators.

He also said the tax discriminated against domestic travel, favoring distant international trips. Even his foreign travel, he says, applies to the whole trip if the ticket includes an intermediate stop within the continental U. S., Dornan noted.



QCA C-47S AMERICAN lands at lumbering camp, typical "base take-off/point-to-point" operation, used by the Canadian carrier.

Canadian Airline Serves Migratory Camps

- Queen Charlotte sets up new dual operation, flying scheduled routes and bush flights to floater towns.
- Carrier reorganizes its system, forecasts traffic and revenues this year will climb to record highs.

Vancouver, B. C.—Queen Charlotte Airlines has set up a dual operation in Western Canada, flying scheduled service on a trunkline basis and operating bush flights to logging towns that route on into along the coast.

Officials of QCA forecast the reorganization will boost traffic and revenues this year to the highest point since the carrier began operations in 1945.

• Zoned Traffic—Key part of the reorganization is a flexible structure of half-weekly routes between the airline board it was incorporated to charge on a strict mileage basis for flights to British Columbia logging camps that require local fuel to forest.

Queen Charlotte blocked off its bush operations into 25 six-square zones, set up a rate of \$10 per passenger on Vancouver flights within one zone or to an adjacent one. For each additional zone, QCA added \$10 to the fare.

On scheduled flights between stationary points, the airline established fares considerably lower than the zone traffic. Example: the 1 to 45 mile, Gussu transport flight between Vancouver and Kysan set at \$40.

• Divided System—QCA also has di-

vided its system into two divisions operating a trunkline service on the north and logging bush flights to the southern sector.

The new structure:

• Northern Division, based at Prince Rupert, B. C., operates the carrier's Route 4, stretching out to the Queen Charlotte Islands off the British Columbia and Alaska coasts, and Route 3, flying east and north up the Port-land Inlet to Alice Arm and Stewart, B. C.

• Southern Division operates out of Vancouver, flying the coastal Route 1 to Prince Rupert and the northwest Route 2 over the Straits of Georgia to Clatskanie Bay, Vancouver Island.

• Consolidation—The carrier is well along in its efforts to streamline its operation.

QCA has disposed of many of its different types of smaller aircraft, bought two DC-3s and consolidated its routes.

When Queen Charlotte started in 1945 it is a subsidiary to the main company of Spikeway & Highway, Ltd., it grew into an equally "spike and truck" system. Main trunk of the airline became overburdened with com-

plexity as independent feeder aircraft were incorporated on the spine.

To eliminate QCA drew 25 planes of nine different types, employed almost 300 people at seven different bases, and operated four separate divisions of service under 14 different licenses. The whole was held together by some 45 company radio stations.

• Retrochauffage—QCA, close and an aircraft equipment was put on the block. The airline sold its Anson, Stearman and Fairchild and leased a fleet of two DC-3s (15,000 and 17,000 lb), two C-47s and seven Narrowses. QCA also has one and a half Stearman, three and a half Anson, flying both of World War II vintage.

Feeder licenses and charter bases in the Southern Division were transferred to other operators, such as B. C. Air Lines, which also took over 14 radio stations. All QCA agents in the affected area became qualified QCA/DCAL agents. Airways and stations are being modernized. C-47s and DC-3s have been fitted for instrument and night operation. IFR service is being established from Vancouver up the coast as far as Port Hardy. Airways are being kept to accommodate DC-3s at Port-land Inlet, B. C., and other airports.

The Northern Division retains its character of bush operations with seven Narrowses. Non-scheduled and charter operations also are maintained.

QCA has initiated interlocking service with E.A. Airlines between Prince Rupert and Kitikotuk, Alaska. Each

operator operates alternate three days a week, giving even-day bus-loads seven between these two points. Flight takes 30 min.

• Rapid Weather-Fly, now, short in the winter, low ceilings and high mountains make British Columbia a rugged country in which to operate aircraft. QCA has only four radio ranges, a 500 sq mi sector, adding to the problem.

Save an airport approach. If heavy loads are permitted to accumulate on flying bases, the planes will dip a wing and roll over or collapse in a tailspin. That's the problem.

To combat low weather conditions, QCA has established 42 radio weather reporting stations over its service. Some are manned by trained meteorologists, who also supply information to Canada's Department of Transport, which corresponds to the U.S. Civil Aeronautics Administration. Others are run on a much less formal basis. Often operators are not even of license, who report weather in a part-time advice.

• Overhaul & Maintenance—Here is a problem of QCA's overhaul and maintenance problems as told to Airman's Week by Maintenance Superintendent R. J. Laid.

A problem peculiar to airplane operators is that most of the damage inflicted on Queen Charlotte's airplanes is done by birds banging into the fuselage hulls.

The Hawkeye flying last still in commission has R1539 engine the DC-3s and C-47s are powered by R1538.

QCA saw a need for a modification to put R1538 in the Standard for reasons of standardization.

Weathered fuselages on the Coast keep being water out of the amphibious during water landings. Air is taken from the pressure side of engine nacelle pressure and piped to the brake drum area at about 5 psi.

QCA cites three other advantages for the weathered fuselages:

- Helps to dry fuselages quickly if water does seep into the door area.

• Cook bakes during wheel landings. QCA developed its own Coast landing door. The front folds at the tail, leaving a two sections to clear the way. Coast landing is in weight 15 lb less than a standard AirTrain landing door.

Illustrates Standard public house properties (4473443) are standard equipment on Queen Charlotte's DC-3s. Alaska reports that pilots like these because they give good blow-off characteristics and also provide effective braking action during approach and landing—both desirable features when operating from British Columbia's short runways.

• Future—QCA is confident about the future holds. The airline has come a long way from the days when its ground-based communication consisted mainly of unrelieved, open on radio towers.

In 1951, despite a bitter strike fought closer and the airline's re-organization, Queen Charlotte was able to:

- Revenue sales, 1,513,945.
- Revenue passengers, 84,199.
- Passenger miles, 6,311,017.
- Revenue cargo, 598,695 lb.
- Revenue mail, 111,935 lb. at freight rates according to Queen Charlotte officials.



MAIL ROUTES account for "cost of damage" inflicted on the airline's planes.

Airline Subsidies Face Major Economy Tests

Some airline subsidies will be more vulnerable in the next 12 months than others have been in the Democratic Administration and Congress wrote the Civil Aeronautics Act in 1938.

Strong economic philosophies of men in the White House, Commerce Department, Civil Aeronautics Board and Congress will clash in some degree on the question of airline subsidy.

Here are some general positions:

- **White House:** No opinion rendered as yet. Economic arguments is a carefully balanced.
- **Commerce Department:** Forced Undersecretary Robert Murray and his influential deputy, Charles Derrig, want to slash subsidies. Murray has some definite ideas on getting federal government out of local problems.

During agency and overboard a book for Brookings Institute maintaining that federal subsidies are justified only where the national security is involved.

• **Congress:** Some cuts are likely. Administration pointed out in CAB seem to expect Congress to cut subsidies for some competitive services on low-cost routes—such as Seattle-Hawale, citing Hawaiian Island routes—low-cost Congress is unpredictable because next year will be the first time such subsidies have been a major appropriation item.

• Civil Aeronautics Board: On Sept. 15, the Board will ask the White House to budget subsidies to cover all costs and subsidies rates that CAB has granted. Some Republicans at the Board, however, are expected to hint to White House that Congress an alternative to some subsidized competitive services might not be disastrous.

Italy Grants Routes To U.S.-Backed Line

(McGraw-Hill World News)

Rome—Agreement covering contracts to be granted U.S.-backed Line Aereo Italiano (LAI) and Bernabucci Airlines, Intercontinental (Alitalia) and regulations governing the operation have been signed by the cabinet and the Italian Ministry of Air Defense.

Under the agreement, both carriers are given first use of government-owned radio stations for communication with military aircraft, and will have scheduled stops and free access to airports. Government operated airports facilities at scheduled stops also are made available without charge.

• **Passes in Italian**—to turn the government needs that the airline pro-



Once is not enough!

The need for blood is greater than ever, not only for men wounded in combat, but here at home... in case disaster, to meet accidents and disasters, and to prepare for civil defense.

Our guests can ONLY be met, if those who give keep on giving... regularly!

You CAN give more than once... as often as every three months with complete personal safety. The more often you give the more often you save a life. For every pint of blood you give gives to someone who needs it desperately.

Remember... once is NOT enough. Give blood again and again! Call your Red Cross, Armed Forces or Community Blood Donor Center for an appointment to give blood today.

GIVE BLOOD

...give it again and again

BUSINESS EXECUTIVES! CHECK THESE QUESTIONS

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ HAVE YOU CHECK YOUR EMPLOYEES' TIME OFF TO MAKE BLOOD DONATIONS?
- ☐ ARE YOUR EMPLOYEES GIVEN ANY INFORMATION TO DONATE?
- ☐ DO YOU HAVE A BLOOD STORAGE SERVICE AVAILABLE IN YOUR COMPANY?
- ☐ HAVE YOU ARRANGED TO HAVE A BUSINESSMAN MAKE REGULAR VISITS?
- ☐ HAS YOUR MANAGEMENT DISCUSSED THE LOCAL BLOOD DONOR PROGRAM?
- ☐ HAVE YOURS BEEN EMPLOYEES OF YOUR COMPANY'S PLAN OF CO-OPERATION?
- ☐ HAS THIS INFORMATION BEEN THROUGH YOUR PLAN, HALLS OR ON BOARD AIRCRAFT?
- ☐ HAVE YOU CONSIDERED A BLOOD PLATE COMPANY IN YOUR COMPANY?
- ☐ HAVE YOU SET UP A BLOOD DRIVE TO GET EMPLOYEES TO GO TO THE NEAREST BLOOD DRIVE OR TO THE NEAREST BLOOD DRIVE?

Remember: as long as a single pint of blood may mean the difference between life and death for any American... the need for blood is great!



NATIONAL BLOOD PROGRAM

debt, managing director, general manager (technical and commercial) and two-thirds of the director must be Italian and 60% of the capital must be held by citizens of Italy.

Senators in Rome reported last month that Trans World Airlines may sell its 40% holding in LAI (Aviazione Vacanze Aug. 23, p. 33).

The companies are under the technical supervision of the Air Ministry, to which they must submit balance sheets and certain statistical data. The Ministry approves the types of aircraft purchased by LAI and Alitalia.

Both airlines are ordered to give priority to Italian sources when purchasing supplies.

Conditions being equal, they must place their resources with Italian firms.

► Domestic Routes-Alitalia has been granted these domestic routes until May 4, 1957: Turin-Milan-Venice-Trieste, Milan-Genoa-Naples-Palermo, Milan-Rome-Catania, Rome-Naples-Cagliari, Cagliari-Milano and Rome-Trieste.

LAI is allowed these routes until April 15, 1957: Rome-Florence, Venice-Bologna, Rome-Turin, Rome-Palermo-Rome-Cagliari, Rome-Naples, Palermo-Catania, Rome-Milan, Milan-Venice, Palermo-Palermo, Palermo-Tripoli, Palermo-Tripoli, Palermo-Tripoli-Catania.

Six other services will be assigned to LAI "provided that as from now until July 28, 1954, they are not expected to be satisfactory, regular services."

The six new routes: Rome-Genoa, Rome-Naples, Bari-Lecce, Rome-Florence-Bologna-Milan, Genoa-Puerto Corico-Cagliari-Palermo-Catania-Rome-Catania, Rome-Milano-Cagliari-Romagna-Catania-Catania-Romagna-Catania.

N. Y. Airport Awards Total \$256,603

Contracts totaling \$256,603 for equipment and improvements at New York International (Idlewild) and La Guardia Airports have been awarded this construction by Port of New York Authority, operator of the field.

• **John A. Rockwell's Sons Corp.**, Tulsa, Ok., \$175,311 contract for utility to be used in expanding the electrical distribution system at Idlewild.

• **Federal Electric Products Co.**, Crescent Ave., Long Island City, N. Y., \$27,500 contract for switch gear equipment to be used in future construction of an electrical substation as well as to meet additional lounge needs at Idlewild.

• **Asheboro Glass & Stone, Inc.**, Florham, N. Y., \$12,815 contract to purchase heavy panel glass and repair minor damage from stone settlement at La Guardia.



DAMAGED UNDERSIDE of American Airlines CV-240 is checked after safe landing.

Convair Collision Puzzles CAB

Milwaukee offices of a Cleveland-based United States Convair 240 and an American Airlines Convair 240 enroute to Detroit at 11,000 ft. above Michigan City, Ind., still was being ascribed last week by a three-man team from Civil Aeronautics Board's Chicago office.

CAB and airline industry officials could offer no explanation of how two loaded aircraft merged a fatal crash when they collided in flight.

► **Minor Damage**—UAI's plane loaded safely at South Bend despite a 4x10 ft. gash on top of the fuselage behind the cockpit.

AA's transport returned to Chicago August—where both planes had taken off slightly more than a minute apart—showing a three-foot gash in the lower side of the fuselage near the tail.

► **Calvin's Sequence**—Pilot's report on wreckage indicated.

► **Collision** occurred in bright moon was moving into darkness. A light moon was shining that night. United's plane had been cleared to fly out to Cleveland on visual flight rules. American's Convair was cleared shortly after on VFR in the same outboard traffic pattern. Both were assigned as 11,000 ft. enroute altitude.

► **American's Convair** was at its 11,000-ft. enroute altitude when the top of the UAI 310's cockpit scraped the bottom of the 240's fuselage.

► **Flare Escape**—Crews of the transports reported later that neither had seen the other in the air until they happened. But contact here, however, is not believed to have caused the crash.

With the backlog of both planes damaged, they immediately had been sent to their own shops for repair. The two were sent to their own shops for repair. The two were sent to their own shops for repair.

Both Convairs landed unscathedly before the pilots realized full extent of the damage. Passengers were shaken up, but there were no casualties.

In capturing the crash on Fred Fox, chief investigator by CAB, Hagan K. Hovner, Hartford, and G. H. 840, wagon, all of Chicago. No date has been set for a hearing on the accident.

Bi-Nation Airport Nears Completion

(McGraw-Hill World News)

Geneva—An international airport terminal, financed by each of two neighboring countries is nearing completion in Melun, France.

In 1953, Melun signed an agreement with Rome, Switzerland, to build a new airport to serve both countries. Under the agreement the airport (in France) would be internationalized and a Swiss-built terminal would be built adjoining the field to the Swiss side.

France provided 1,558 acres of land and the Swiss provided the terminal building. The Swiss will finance the permanent facilities, including customs, at a cost of approximately \$10 million.

All materials needed for building the field can be imported from the U.S. Excess capacity costs and profits will be distributed.



**Dallas,
Texas
OFFERS**

ENGINEERS

and OTHER TECHNICAL PERSONNEL

GOOD POSITIONS IN

AERODYNAMICS
ARMAMENT
LOFTING

CONTROLS
STRUCTURES
FLIGHT TEST

ELECTRICAL INSTALLATION
POWER PLANT INSTALLATION
FLUTTER & VIBRATION
ANALOGUE & DIGITAL COMPUTERS
ENGINEERING PROCEDURES & PLANNING

EXCELLENT OPPORTUNITIES
HOUSING READILY AVAILABLE

ATTENTION ENGINEERING PERSONNEL

BOX 6191, DALLAS, TEXAS



Hayes Aircraft Corporation

Birmingham, Alabama

is one of the largest multi-engine aircraft modification centers in the United States. With state-of-the-art facilities constantly modernized and expanded. In addition, Hayes is designing many prototype modifications and manufacturing kits for many special Air Force projects. Hayes is a leader in the industrial experience of the South, and is famous in aircraft engineering.

Top flight design positions are now open to qualified aircraft engineers for:

- ELECTRONIC INSTALLATION DESIGN
- ELECTRICAL INSTALLATION DESIGN
- FUEL SYSTEM DESIGN
- STRUCTURAL LAYOUT MEN
- LOFTSMEN
- CHECKERS
- HYDRAULIC DESIGN
- TECHNICAL WRITERS and
- ASSISTANTS

- AIRCRAFT
ENGINEERING
- MODIFICATION
- OVERHAUL

Write to:
Executive Engineer
Hayes Aircraft Corporation
P. O. Box 2387
Birmingham, Alabama



A GOOD CONNECTION

That's what the jet pilot says when he "picks out" the PR refueling system and knows where forward thinking engineers are provided say when they study the opportunity for growth with Flight Refueling, Inc., a company expanding its service, long range bases on the whole new field of in-flight refueling.

We have immediate openings with a future firm

DESIGNERS
CHECKERS
PROJECT ENGINEERS
TEST ENGINEERS

We need engineers with experience in design development or testing of air transport and aircraft equipment, past or present in the aerospace field. We want test engineers with background in aircraft fuel system component and maintenance development.

Your resume giving details of education, experience, and active requirements will be held in strict confidence.

Write today to:
Personnel Director
**FLIGHT
REFUELING, Inc.**
Danbury, Conn.



ENGINEERS!



ADVANCED PROJECTS OPEN
NEW CAREERS AT RYAN

- Airframe Designers
- Stress Analysts
- Power Plant Engineers
- Aerodynamicists
- Electronic Engineers
- Draftsmen and Technicians

Report to
Director of Engineering
and be held in strict confidence

RYAN
AERONAUTICAL COMPANY
San Diego 16, California

Help Build Tomorrow's World TODAY!



GOODYEAR AIRCRAFT CORPORATION, pioneer and leader in lighter-than-air craft, offers you a new employment opportunity with a well-established and fast-growing company where "careers are planned."

DESIGN AND DEVELOPMENT engineering opportunities are available for capable and imaginative men and women in the field of airships, aircrafts and aircraft components.

RESEARCH AND DEVELOPMENT projects — missiles, electronic and electronics systems, servomechanisms, new special devices, fiber optic transmitters — all present an urgent need for engineers with fresh talent, aptitude and ambition.

POSITIONS ARE OPEN at several levels in various fields with salaries based on education, ability and experience.

Physicists

Mechanical engineers

Aeronautical engineers

Welding engineers

Civil engineers

Electrical engineers

Technical editors

Technical illustrators

AKRON, THE HOME OF GOODYEAR AIRCRAFT, is located in the lake region of northeastern Ohio. Cosmopolitan living, year-round sports and recreation, cultural and educational advantages make this thriving city an ideal spot for a pleasant home.

YES, BUILD YOUR FUTURE — TODAY! Write, giving your qualifications, or requesting an application form.

C. G. Jones, Salary Personnel Department



GOODYEAR AIRCRAFT CORPORATION, 1210 MASSILLON RD., AKRON 15, OHIO

LETTERS

Fuel Gages Again

The engineering staff here at McDonnell has oftened with such interest and enthusiasm the articles in *Aviation Week* which you have published recently concerning aircraft fuel gages.

In view of the conflicting statements that have been made, I think you may be interested in the following facts, as furnished to the Atlantic City airport post office.

A McDonnell Aerospace, Inc. purchased in 1956 two test capacitive aircraft fuel gage manufacturers made in the Soviet Union on a contract basis—installations made on Douglas DC-4s and converted C-119s.

B. Today, when much sensitive equipment of this vintage has been located or retired, most at this airport, some twenty-year old, capacitive gages in addition to the known accuracy, trouble-free, without subject to the intensity of liquid fuel.

Two, plus the fact that McDonnell gages have operated in recent tests, two have been used in U.S. Air Force flights, as well as for the new Vietnam Veterans which are being purchased by Trans-Canada Air Lines, it is believed, some time in the future of the national leadership of this type of fuel gage.

Because of the large number of airline and military personnel who have been recommended to us on the controversial matter as published in your "Letter" column, it would be appreciated if you could provide publicity in the above statements.

Respectfully,
McDonnell Aerospace, Inc.
Troy, N.Y.

On Custer, No Bias

In reading your January aviation magazine, I noted many more than one error. Mr. Anderson's article in the "Custer" column of Wing in your issue 11 was one. I think it is understood that I do not own any stock in Mr. Custer's company and as fact Mr. Custer would know me if he told me.

Mr. Anderson's article appears to be strongly biased with an opinion toward Mr. Custer's development. I have no effect to discuss it. Perhaps a stress from Custer's apparently fantastic performance claim at Custer. Mr. Custer let it be known that it is a claim of technical nature. If the reason be the former, it might be understandable, but if the latter, it would be outrageous. Last questions must be around of such disbelievers but rather leave it to the technical boys who so actively monitor the new claims between the so called "bureau" and "military," although history can frequently be used to disprove them.

Mr. Anderson quotes excerpts from a recently issued NACA report on some tests of a Custer Channel. It was very reliable. The report said both some good points and some bad points, but Mr. Anderson has

brought forth all the bad with possible evidence on the poor control characteristics. It would appear that the test vehicle was a temporary crude experimental adaptation of materials in a portion of a standard well known airplane in view of the same manner that Custer attacked by airplane after in an old days language. It may be that Mr. Custer was aware of the control problem or possibly the standard test was needed to determine such control characteristics. I suggest that mechanical tests of some early helicopter models would reveal some rather new control problems, and just not could we get into the "Custer Channel" field. In any case, let's give Mr. Custer the benefit of the doubt.

For half a century we have followed at steadily one principle of flight with promise for only some improvements in the present state. It's true, we have moved but in the short span of 50 years, probably better than any other art, and there is much of which we should be really proud. Some of our progress, however, at least in the last few years, has been in tactics, weapons and in a limited amount, a completely new, what a sense, we have almost reached the point of bringing about how complicated we have made things. To increase complexity and add to progress is a desirable aim of Custer's Channel.

Most of the improvements of recent years certainly have come from the efforts of design engineers and research engineers and without them the advances would be "backyard" inventions, although the possibility always there and its efforts must not be discounted. I do not wish to imply that Mr. Custer is just another "backyard" inventor, but I doubt that he has had as advanced scientific facilities or large staff of engineers as he claimed.

It may be that we have moved so fast in this art that we have strayed somewhat from basic principles and it would certainly be helpful if we did some basic thinking. We would do well to start by reviewing the classic on gas pressure in air—dynamic pressure, lift, drag, etc. If we then derive, regardless of what theory we proposed or believe we attach, as tested and supported as we wish, or as better of a differential of air pressure between the upper and lower surfaces of the airfoil. Regardless of how it is done, if we can produce less air pressure on the upper surface of an airfoil than we have on the lower surface, we obtain a vertical control force which we call lift. Mr. Custer's method may be open to debate and his channel idea may seem almost to me, but the principle he uses is sound. I personally am not convinced that pushing or pulling a wing through the atmosphere is the absolute means to obtaining lift.

According to press releases, Mr. Custer now has his Channel Regular concern with channel structure, and if the airplane achieves the performance claimed it will be truly fantastic. If, on the other hand, the airplane does not take off at 15 mph but requires 70 mph, in any book he will have achieved that which should interest

something better than today. I prefer to wait and see.
Yours very truly,
B. C.

(It is useless to suggest. An actual model of Custer's Channel was shown at the NACA report. The model size [Din. 15, 16"] which I note appeared clearly, and that I wasn't convinced by the demonstration I did, and I wasn't. But the NACA tests should answer the claims made by Custer. We started the article by getting the claims, and then the NACA tests in applied to each claim. We did the tests, as that a reader would be able to see the point in which along. There is no reason to doubt the basic principle underlying Custer's channel wing. Research has shown that applied, and pressure differences, regardless of how produced, will result in lift. The only question seems to revolve around whether this configuration is more efficient than others. One line which I might well have quoted from the NACA report is "The test conditions of popular opinion, blade angle and popper-channel configurations were carefully controlled to remove the confusion generated by the design for the experimental lift coefficient test." For the moment then, I'll repeat the NACA test results. I'll also wish Mr. Custer all kinds of success in developing the configuration, because flying really is the test of performance. Let's choose for—D.A.A.)

Underground Plant

I have received a note that of the article entitled, "How Many Plant Escaped from Bunker," which appeared in your Age 10 issue and which described some of the various activities of our client, The Finney Co. Ltd., Bland, Kansas.

I would like to draw your attention to a misstatement contained in the second sentence. The reason is under the section of the London underground system was taken not because the company's plant had been bombed out, but rather is a means of obtaining any maintenance with the production of material service equipment, should that contingency arise.

In connection with many organizations facing this difficult problem, our client had developed their manufacturing facilities to secondary works throughout the country. It was realized, however, that such dispersed facilities could only increase the risk of interruption by aerial warfare.

As one of the end result of such of the work in hand, many had to be moved to the underground. Our client had the tunnel described in your article, of which approximately five miles were utilized, by very close to the present population and was for much of its length 50 ft below the earth's surface.

Its adoption into this unique factory, despite numerous engineering difficulties, is a fine further example of Finney's fine for improvement.

CONRAD C. MAXWELL
British & Foreign, Ltd.
Roper House
Tottenham St., London



HUFFORD STRETCH-WRAP FORMING MACHINE MODEL 60

HUFFORD
MODEL 60
CAPACITY, 300 TONS

World's Largest Stretch-Wrap Forming Machine

Goes to work for North American Aviation Inc., Columbus, Ohio

The Model 60 is Hufford's largest stretch-wrap forming machine to date, exceeding the capacity of all existing stretch-wrap forming machines in the world today.

With its 763,720 pounds of "pull" it is now forming stabilizer fairings, patch and fuselage skin parts for the new FJ-2 FURY. Now that will utilize its huge capacity on sheets measuring 6 feet wide by

333 feet long. Its tremendous strength enables formation of sheet thicknesses as great as 3 inch!

The Model 60 opens another chapter in stretch-wrap forming history, almost doubling the capacity of the largest Hufford press heretofore built. It is Hufford's answer to unusual requirements of the present in preparation for the conquests of the future.

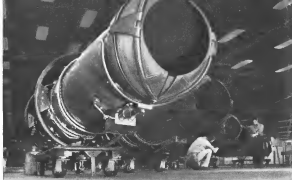
Hufford

HUFFORD
Hufford Machine Co.
11000 E. 10th Avenue
Denver, Colorado 80231

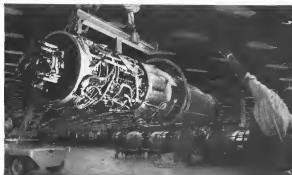
Manufacturers of
Stretch-Wrap Forming Machines
Since 1925



ONLY ONE-MAN INTERCEPTOR in operation today, North American F-86D is powered by G-E engine which requires minimum pilot attention.



AUTOMATIC CONTROL of the variable area nozzle (illustrated above) regulates exhaust velocity and temperature.



MOST POWERFUL of J47 family, afterburner version gives F-86D Sabre Jet extra power to climb quickly for interception.

Easy-to-operate G-E Jet Engine Lets Pilot Concentrate on Interception

Electronic "Brain" Permits Complete Engine Control with Single Lever

INSTANT BURSTS OF POWER plus simplicity of operation make G.E.'s J47 with afterburner an outstanding powerplant for high-altitude interception. Powering the North American F-86D, America's first one-man rocket-armed interceptor, the afterburner version of the J47 is equipped with automatic electronic controls. For *any* throttle setting, the controls maintain *optimum engine performance under varying flight conditions*. This allows the pilot to focus his attention on his main job—*seeking out enemy aircraft!*

"SENSORS" FEED INFORMATION pertaining to engine pressure and temperature, air temperature, fuel-flow, and other variables into an electronic "brain." The

brain compares power needs with engine performance. Adjustments, if necessary, are then made *automatically* as the "brain" controls fuel-flow and variable area nozzle on the afterburner.

AUTOMATIC ENGINE CONTROL is supplemented by other features such as anti-icing provisions which are essential to high-altitude interception. These engineering accomplishments have been factored into the J47 by G.E.'s design, development, and manufacturing organization—an organization that is actively proving that *"Progress is General Electric's most important product."* Section 230-13, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL  ELECTRIC